JANUARY 1951

THE MGA BULLETIN

No. 22

ORGAN OF THE MUSHROOM GROWERS' ASSOCIATION

CONTENTS

EDITORIAL ... Page 15
PRESS CUTTINGS ... ,, 16
RESEARCH FOR ITALY ? ... ,, 17
WARNING ! ... ,, 17
REPORT FROM THE RESEARCH FIELD ... ,, 18
MUSHROOM RESEARCH FUND ... ,, 19
CROPS FROM SAWDUST : Dr. Kurt Lohwag ... ,, 20
RESEARCH PROGRAMME : Dr. R. L. Edwards ... ,, 21
STANLEY MIDDLEBROOK'S DIARY ... ,, 24
MY WAY OF GROWING : 4—R. R. Howse ... ,, 27
MUSHROOM DIFFICULTIES IN DENMARK : Prof. H. Paludan ,, 29
SOIL RESEARCH IN ITALY : G. Borzini ... ,, 32
CREOSOTE CAN BE DANGEROUS ... ,, 33
U.S. GROWERS ALARMED ... ,, 34
ITEMS OF INTEREST AND CHANGES OF ADDRESS ,, 37
OUR GEORGE ... ,, 38
NORWEGIAN MUSHROOM GROWING : P. Hjort ... ,, 39
CORRESPONDENCE ... ,, 40
DELECTABLE DELICACY : Fred. C. Atkins ... ,, 41
MUSHROOM LUNCH ... ,, 42
FIFTH ANNUAL MEETING ... ,, 45
EELWORMS (NEMATODES) AS PESTS OF MUSHROOMS : Dr. C. A. Thomas and G. H. Mitchell ... ,, 61
STERILIZING CASING SOIL WITH FORMALDEHYDE : Dr. E. B. Lambert ... ,, 72
MUMMY DISEASE : Dr. C. Fleury ... ,, 73
LIST OF NEW MEMBERS ... ,, 84

PRICE 5/-

Printed for the Mushroom Growers' Association, Yaxley, Peterborough, England by W. S. Maney & Son, Russell Street, Park Row, Leeds 1

All the Best mushrooms
go to the LARGEST DISTRIBUTORS
IN THE UNITED KINGDOM —

BROOME & GREEN (London) LTD.
COVENT GARDEN MARKET, LONDON

BROOME & GREEN (Glasgow) LTD.
CANDLERIGGS MARKET, GLASGOW

SOMERS & GIBSON LTD.
MANCHESTER & BLACKBURN

REGISTERED B&G TRADE MARK

Waltham Cross Depot — the loading shed

50 YEARS AT YOUR SERVICE

Appreciation of your problems, up-to-date knowledge of all aspects of your work, and an efficient organisation combine to give you the complete horticultural service. Our business is to understand yours.

WE SUPPLY EVERY REQUIREMENT

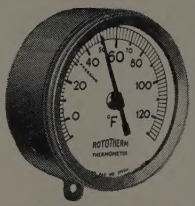
for growing, packing and marketing mushrooms, fruit vegetables and flowers

GEO. MONRO LTD.

Main Depot : Hertford Rd., Waltham Cross, Herts.
Telephone : Waltham Cross 3663 (5 lines)

CHANNEL ISLANDS : Esplanade, Guernsey (Guernsey 310). CORNWALL : Long Rock, Penzance (Marazion 108). ESSEX : Gt. Totham, nr. Maldon (Wickham Bishops 390). GLOUCESTERSHIRE : Malthouse Lane, St. Paul's, Cheltenham (Cheltenham 3812). HAMPSHIRE: Railway Goods Yard, Swanwick Station (Locksheath 2259). ISLES OF SCILLY: The Quay, St. Mary's. KENT : Forstal Wharf, Aylesford (Aylesford 7373). LINCS.: West Elloe Av., Spalding (Spalding 2809). SCOTLAND : 12 Ingram Street, Glasgow, C.1 (Bel 2166). SUSSEX : Corn Exchange, Worthing (Worthing 357).

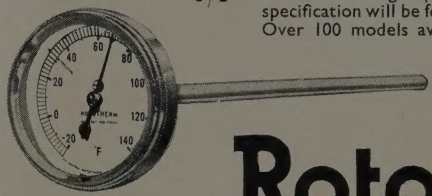
Monro's
Everything for the grower
Wholesale only



GREENHOUSE THERMOMETER Price **7/6**

Accuracy at a glance

The two dial thermometers shown here are particularly suitable for use by the modern scientific grower. The clear dial enables critical temperatures to be instantly seen. The high standard of accuracy, and moderate price of the Rototherm dial thermometer, makes it a necessity to all progressive growers. The Light Immersion Model is the ideal thermometer for measuring mushroom bed temperatures, as well as soil sterilising, liquid temperatures, etc. Full specification will be forwarded upon application. Over 100 models available.



LIGHT IMMERSION THERMOMETER Price **39/3**

Rototherm
DIAL THERMOMETERS

THE BRITISH ROTOTHERM Co. Ltd., Merton Abbey, London, S.W.19
'phone : LIBerty 3406

CRAVEN PRODUCTS
FOR WINTER USE

"CRAVENITE No. 3" SOIL FUMIGANT for destroying Leatherjackets, Millepedes, Wireworms, etc.

"SOLUBLE CRESYLIC ACID" for sterilizing soil in greenhouses and for washing down. Soluble Cresylic Acid is also extensively used for disinfecting and cleaning tomato canes. We are also makers of fruit tree winter washes, viz. :—

"CARBO-CRAVEN" Tar Oil Ovicidal Wash

"PARA-CARBO" Tar Petroleum Wash

"WINTER-SOLOL" Petroleum Emulsion

"CRESOFIN" Dinitro-Ortho-Cresol Emulsion

Full particulars apply:

W. J. CRAVEN & CO. LTD.
48-50 PORT STREET :: EVESHAM, WORCS.

BANKERS: MIDLAND BANK LTD.

THREE COMPANIES
"Specialising"
MUSHROOMS

EMSLEY & COLLINS (BRADFORD) LTD.

ST. JAMES' MARKET
BRADFORD

TELEPHONES 28723/4 — *TELEGRAMS* FRUITFUL

EMSLEY & COLLINS (HALIFAX) LTD.

PIECE HALL
HALIFAX

TELEPHONES 3738/9 — *TELEGRAMS* FRUITFUL

EMSLEY & COLLINS (HUDDERSFIELD) LTD.

BROOK STREET
HUDDERSFIELD

TELEPHONES 2971/2 — *TELEGRAMS* FRUITFUL

— PROMPT RETURNS —

"WESTDOCK"
REG^D TRADE MARK

MUSHROOM TRAYS

PRESSURE TREATED TRAYS
for the discerning MUSHROOM GROWER

- Trays supplied in any size.
- Specially manufactured for roller conveyor systems.
- Wire mesh bottoms if required.
- Backed by the well-known Westdock quality production.

Ask for details of our other products.

WRITE NOW FOR PRICES

WEST DOCK TIMBER Co LTD HULL

Phone: 37738 (3 lines) Grams "Woodcraft Hull"

PINKERTON'S PROLIFIC

PURE CULTURE SPAWN

DISCERNING OVERSEAS GROWERS PREFER OUR SPAWN, SO THE DEMAND IS FOR PINKERTONS "PAR AVION," PLEASE

An overseas consignment being put on board a "Flying Dutchman"

Write to-day for full particulars

PINKERTON'S

Scottish Mushroom Laboratories

MILLERSTON, GLASGOW

'Phone : PROvanmill **4260** 'Grams : "PROLIFIC" Glasgow

IT'S A GOOD POLICY

TO

PLACE **ALL** YOUR **INSURANCES**

WITH

THE N.F.U. MUTUAL

EVERY POLICYHOLDER A PARTNER

★

The National Farmers' Union Mutual Insurance Society Limited

Head Office: STRATFORD-ON-AVON

A SPECIALITY FOR MUSHROOM CULTIVATION

FRESH

LONG WHEAT STRAW

STABLE MANURE

Direct from Stud Farms and Racing Stables

PURCHASE FROM A FIRM WITH A REPUTATION WHICH KNOWS THE QUALITY OF MANURE YOU REQUIRE

Certified weighbridge Ticket with each consignment or load

Delivered by road or rail to any station or farm at reasonable prices per ton

★

GEO. WILKINSON

17 MAYTHORNE ESTATE

LEYBURN, Yorks.

Telephone: LEYBURN 2123

THIS IS IMPORTANT!

BIRMINGHAM'S LARGE POPULATION Requires

Best Quality MUSHROOMS

GEO. JACKSON & CO. LTD.

Telegrams: "ORANGE" BIRMINGHAM

SMITHFIELD MARKET
BIRMINGHAM 5

Telephones: MID. 2232-3-4

SPECIAL DEPARTMENT
FOR
SALE OF MUSHROOMS

Enquiries Invited

POUPART'S
KEEP YOU GROWING

Some 50 years ago, we commenced selling CULTIVATED MUSHROOMS on our stand in the CENTRAL AVENUE, Covent Garden, where we have been handling them ever since, as well as at our ASSOCIATED COMPANIES and BRANCHES.

We feel that this amply testifies to the efficiency of our sales service and the inducement thereby offered to our senders, not only to *keep growing*, but also to extend their production.

Personal attention to each grower, whether large or small, is a feature of our service, and by means of a mark, which we allocate, each sender preserves his individuality, and never becomes "just one of a crowd."

We welcome enquiries from new growers and those who wish to change their present marketing arrangements.

CHIP BASKETS and other PACKING ACCESSORIES can be supplied for immediate use.

T. J. POUPART LTD.
COVENT GARDEN, LONDON W.C.2

Tel.: TEM. 9001/8 and TEM. 7383/87

BRANCHES

SPITALFIELDS, E.1. Tel. Bis. 7444. BRENTFORD Tel. Chi. 1831

ASSOCIATED COMPANIES

SOUTHAMPTON - Tel. 3363. BRISTOL - Tel. 24255
CARDIFF - Tel. 141/142. LIVERPOOL Tel. Royal 8601

IMPROVED

"IDEAL" PACKAGES FOR MUSHROOMS

IN 2 lb. AND 4 lb. SIZES. Stronger, more attractive in white, non-absorbent woodpulp board.

Ample Ventilation :: Secure Cover
No Sweating :: Easy to Handle

We have been fortunate in obtaining the special material eminently suitable for packing mushrooms and assuring their arrival in the market in the best possible condition.

★

Samples and prices on application

F. GOUGH & SON Ltd.
63-69 Fishergate, NORWICH

'Grams :—" Containers, Norwich "
'Phone :—Norwich, 25221-2

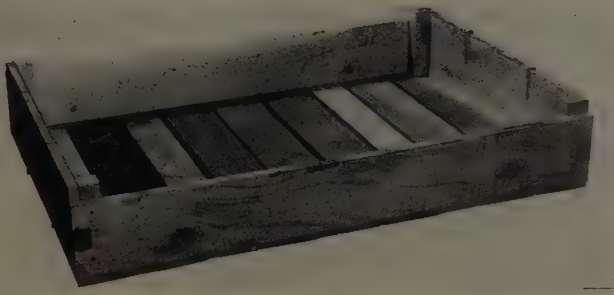
SERVICE AND SATISFACTION!

Yes, this means a lot to the GROWER –then why not take advantage and pack your produce to the ORGANISATION that has built up, and **ALWAYS SPECIALISED** in the DISTRIBUTION OF MUSHROOMS

J. V. WHITE & CO. LTD.
Smithfield Market, BIRMINGHAM 5
Tel. MID. 0735 (3 lines) 'Grams "White Smithfield Birmingham"

Are You Interested IN THE TRAY SYSTEM?

WE MAKE THE TRAYS TO ANY SIZE YOU REQUIRE



M.G.A. Standardised Tray: 3′ x 2′ x 5″ x 6″ in $\frac{5}{8}$″ hardwood (no licence), or softwood (licence). These Trays have corner posts, metal corner supports and are wire reinforced.

BEE-RITE BOXES

Broadway, YAXLEY, Peterborough

'Phone YAXLEY 246

by installing

WATFORD HANDCRAFT HUTS

(PATENTED INTERLOCKING ASBESTOS CEMENT CONSTRUCTION)

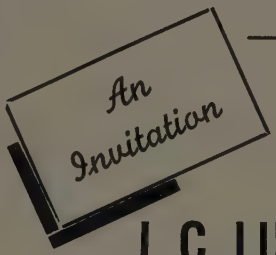
THESE Huts are especially suited to the requirements of Mushroom Growers, many of whom are using Watford Handcraft Huts supplied by us. They are indefinitely extensible, comprising double cranked reinforced asbestos cement sections made with a girth of 12′ 0″ by 48″ width giving nett cover—including lapping—of 45″. The span between lining sheets is 18′ 0″ allowing a clear width entirely free from obstruction of 14′ 0″ at a headroom of 6′ 6″. Any suitable wall construction may be used for the end walls including 4½″ brick panels, breeze blocks, hollow blocks or asbestos cement sheets. The use of structural timber is entirely obviated and steel requirements reduced to 34 lbs. of seam bolts and washers per Hut × 36′ 0″ length. Owing to improved conditions of supply, these Handcraft Huts can now be offered complete with asbestos cement flat sheet linings if desired.

Full particulars and specification from

STANDARD RANGE & FOUNDRY CO. LTD.

QUEENS ROAD, WATFORD, HERTS.

Telephone: WATFORD 2261 (6 Lines) ● *Telegrams:* "STANDARD, WATFORD"



Send your Marketable Produce to :

J. C. LUCAS & SONS LTD.

FRUIT AND FLOWER SALESMEN

Castlefolds Market

SHEFFIELD

BY DOING SO

YOU ARE SURE OF HAVING A STRAIGHT DEAL

Telephone **22618** :: FLOWERS, **25990** :: HOME, **70732** *Established 1888*

● COMPOST FOR MUSHROOMS

WHEAT STRAW when treated with ADCO "M" will readily provide a substitute for horse manure for growing mushrooms

ADCO "M"

IMPROVES MANURE SUPPLIES

● LONG STRAW MANURE

Manure for mushroom culture such as that from racing stables is frequently in too long and dry a condition. This can be considerably improved by using ADCO "M" with better crops as a result.

Particulars & Prices from **ADCO LTD.** HARPENDEN, HERTS

PACKING MATERIALS

Grow for quality and pack for protection and attractiveness. **Care in packing pays handsome dividends.**

We supply a range of packing materials suitable for soft fruit, tomatoes, mushrooms, etc., all of first-class quality and in every way reliable. These include

CHIP BASKETS. CRESS & SOFT FRUIT PUNNETS. BLUE, WHITE & PINK TISSUE. BEST QUALITY RUBBER BANDS. WOOD WOOL. CARNATION SPILLS. PACKERS' STAPLES. SPRING SCALES AND MISCELLANEOUS SUPPLIES.

Illustrated Catalogue sent on request

*

W. DARLINGTON & SONS Ltd.

WORTHING SUSSEX

Established 1860

THE

JANUARY 1951

BULLETIN No. 22

No responsibility can be accepted by the Editor, the Editorial Board, or the Mushroom Growers' Association, for statements made or views expressed in this Bulletin, or for any advertisements included in this publication.

Brush up your Mushroom Growing!

Each year the Editorial Board moans at the amount of space taken up in the January Bulletin by the report of the Annual Meeting and Lunch, but the argument which always succeeds is that only a small proportion of our membership attends these functions, and the rest want to know, or ought to know, what's happening. (This Bulletin is larger than usual, to cheer up the grumblers !)

Last October the proportion was the smallest ever, probably not more than 50 growers participating. Why ? Many Annual General Meetings **are** dull, formal occasions ; but we get **our** routine business over in half-an-hour, and spend the remainder of the afternoon discussing where we have gone wrong in the year just ended and what we want to do during the year ahead. You who have heard these discussions will agree that they can scarcely be termed " formal," much less " dull."

As you will read later in this issue, we agreed to try out two new projects in 1951. The first is a series of informal " get togethers " which we are calling **Area Meetings** and which will be held at as many conveniently-central points as we can fit into our busy Yaxley calendar. Details will be circulated in due course.

The second innovation is a **Refresher Course** for Mushroom Growers. I am aware, Sir (or Madam), that you may have no need for such a course, but we are thinking of the grower who, disturbed by the inexorable rise in the price of everything but mushrooms, thinks it might not be a bad thing to put aside his hose-pipe for a moment and come along to Peterborough on 24th and 25th January, to hear about some recent developments which may be of value to him, and to talk things over with the other growers present.

We are all in the same boat. So, in place of the Chairman's customary Pep Talk, I simply invite you to join us in this effort to " Brush Up Our Mushroom Growing." You'll not regret it, I assure you.

Fred C. Atkins.

PRESS CUTTINGS

Over 200 growers went to a successful conference at York on 26th September. Mr. Stanley Middlebrook, the well-known mushroom grower of Brayton . . . raised the controversial subject of **trays** compared with conventional shelves. He has tried one house with trays and believes that this system, when costed properly, has no advantage. One grower he knows has changed from shelves to trays and now wishes he had not.

Grower (7.10.50)

As from 1st October, **seating requirements** in all premises covered by the Factories Act apply to all workers engaged in tasks that can properly be done sitting, as well as for the type of work which affords only occasional opportunity for sitting.

Nurseryman & Seedsman (5.10.50)

The **National Market Produce Show,** which forms part of the Festival of Britain programme, will be held (at Olympia, London) on Wednesday, Thursday and Friday, 27th, 28th and 29th June, 1951.

Fruit Grower (28.9.50)

They brought out the gold plate for the honoured guests at the Wine and Food Society's dinner at the Dorchester last night to celebrate the golden wedding of the President **M. André Simon** and Mme. Simon. Six hundred guests attended this most ambitious banquet since the war. For them were opened 700 bottles of wines or cognacs.

Daily Mail (18.10.50)

The Taylor family from Chesterton Road, Cambridge, have started the colony's first commercial mushroom farm. They have confounded experts by producing 10 tons a month in the comparatively high temperature of the Salisbury plateau using specially-designed beds they built themselves . . . . . Now they have stocked the shops of Salisbury and started a **mushroom air service** to Bulawayo, 300 miles away.

Evening News Correspondent, Salisbury, Southern Rhodesia (9.10.50)

Mushrooms were appreciated in ancient Rome : Caesar Claudius was so partial to them that he ate, without question, a poisoned mushroom offered to him by his wife. Nero called them **food of the gods ;** and the Emperor Charles VI was so fond of them that he forbade their use by his people in case he himself should run short.

Julian Holroyd in *Catholic Herald* (27.10.50)

Civilized people always have more confidence in the grown than in the gathered. Mushroom growing is an important branch of food-production both in Europe and North America.

A. F. Parker-Rhodes in *Fungi—Friends & Foes* (1950)

The members (of the City Pickwick Club) sat down to a traditional **Pickwick pudding** (steak, oysters, kidney and mushrooms).

Evening News (10.10.50)

Under the watchful eye of Ralph Meering, the moss store in the Lea Valley has achieved promising results with **mushrooms,** tomatoes and cut flowers. *Fruit Grower* (17.8.50)

. . . Benzene hexachloride, the gamma isomer of which has at times been named BHC, **lindane,** and gammexane, to the confusion of all and sundriesmen. J. R. Ashton in *The Grower* (26.8.50)

In the fruit and vegetable classes (at the Worthing and West Sussex Horticultural Society's Autumn Show at Worthing), mushrooms were prominent and the quality of the highest. **Church Farm Nurseries Ltd.** took firsts in both classes for chips of white and brown cups.

Horticultural Trade Journal (16.11.50)

This year a few **glasshouse growers** have changed from lettuce to mushrooms for the winter crop. Houses are being darkened and beds laid down. Lancs. correspondent in *The Grower* (18.11.50)

RESEARCH FOR ITALY?

BORZINI, C. *RICERCHE SULLO "PSALLIOTA CAMPESTRIS" FR. E NOTIZIE SULLA FUNGICOLTURA IN ITALIA.* Investigations on Psalliota campestris and notes on mushroom growing in Italy. SUPPL. ATTI IST BOT. LAB. CRITT. PAVIA Ser. 5, Vol. E, 1949, pp. 26, bibl. 41.

The author notes that modern methods have not been generally used in Italy, and he proposes a research programme for his country which would result in the sorting out of the different races of *Psalliota*, a determination of the best casing material including the use of artificial composts, of the best methods of reproducing the fungus and of pasteurizing the media used. A review of the literature covers taxonomic, genetical and physiological aspects of *Psalliota campestris*, the production of spawn and the normal methods of preparing mushroom beds, with a short note on parasites.

Reproduced with permission from Horticultural Abstracts, Vol. 20, No. 4.

WARNING !

" Fresh-sawn home-grown merchantable OAK " was pressure treated with a reputable preservative and supplied by a reputable timber merchant for bedboards. Here are some specimens after one crop !

Report from the Research Field

It is widely believed that there are about 1,000 commercial mushroom-growers in Great Britain. Fewer than 500 regard this crop very seriously ; to the majority it is one among a number, and preponderates only when the market is inflated. Barely a handful of these growers have thought it worth their while to purchase from the Mushroom Research Association Ltd. its five-shilling " Report for Year 1949."

Why is this ? It is indubitably one of the most significant publications in the history of the Mushroom Industry. Not only is a formula given for synthetic compost, with **revised** directions for its preparation—a formula which has already been proved capable of producing yields as high as those obtainable from horse-manure—but also we are provided with a means of peak-heating houses without expensive steam-boilers or where no electricity is available ; we are startled into considering more closely just what our compost really costs, and at last we are told how we can with sufficient accuracy take our own pH readings—all for the outlay of a few pence.

Now any one of these important papers is worth many five-shillings. The more realistic growers, being subscribers to the funds of the Research Association, receive them free. Few of the less progressive growers trouble to subscribe or to purchase a copy, and the primary purpose of this note is to draw their attention to the fact that the 1949 M.R.A. Report is on sale at Yaxley for 5/-.

Why do I trouble ? The answer is quite simply and honestly that, as Chairman of the M.R.A., I have the primary responsibility for extracting from your contracting wallets the funds without which no future Report can appear. And unless all know what Dr. Edwards and his Staff are doing to help us, how can I expect all to subscribe ?

Mr. P. B. FLEGG

A large section of the Industry may still be unaware that the research workers at Yaxley are now " all set " for an attack on the major problem of Casing Soil. Mr. S. Burrows, after more than four years' brilliant work on the complex chemistry of composts, has just left to conquer new fields (Good luck to him !) and his place is taken by Mr. P. B. Flegg, B.Sc.(Agric.) (Reading), whose special field is soils (Good luck to him, too !). Most growers can get horse-manure and have ignored the prospect should it disappear ; few growers can be completely satisfied with their casing soil, or pretend it is beyond improvement. Be patient, and generous, and ask yourselves how else than by

scientific investigation of this calibre can we hope to achieve mastery of the complicated material we use to persuade our compost to fruit.

Miss C. W. H. Duncan is continuing under severe restraints her study of the more economically serious "diseases"—I use the term in a comprehensive sense, and mean it to cover Truffle, Verdigris and Bacterial Pit. I feel it reflects upon our business acumen that we persist in hindering Miss Duncan when a sum as small as £50 would provide her with a much-needed, almost essential, experimental disease room. She might be cramped; she most certainly would have a better chance of helping us in our disease troubles. F.C.A.

MUSHROOM RESEARCH FUND

1950 Appeal reaches £1,820

Despite the serious situation revealed in Bulletin 21 only another £125 has been forthcoming from the Industry, and the Board of Directors was compelled to seek further financial assistance from the Ministry of Agriculture. The Ministry's sympathy did much to minimise the M.R.A. delegates' sense of humiliation, and they left with an assurance that the grant would be increased from 50% to 60% of 1950's current expenditure.

With the £62 handed over by the M.G.A. (being the nett profit on the Open Day), it may be possible to "balance the books" at the end of the year. Prospects for the future are brighter, provided the Industry continues to do its share, as will be seen in the report of the Annual Meeting.

Between 15th August and 10th November, the following contributions were gratefully received :—

	£	s.	d.
C/f. from Bulletin No. 21	1,696	19	2
Harding Bros.	20	0	0
Lyons, J. & Co. Ltd.	10	10	0
Coombe, T. W. B.	9	18	0
Cattermole, F. L.	5	5	0
Cheddar Valley Nurseries	5	5	0
Collier, Sir Conrad	5	5	0
Loddington Farm Ltd. (2nd cont.)	5	0	0
Ohman, Miss I. (Sweden)	5	0	0
Westin, G. (Sweden)	5	0	0
Richards, G. E. A.	4	0	0
Reeve, E. (U.S.A.) ($10)	3	9	0
Merry Orchard Produce Ltd. (2nd cont.)	3	3	0
Moorhouse, J. H.	3	0	0
Short, Mrs. M.	3	0	0
Kuhn, Jorg. (Switzerland) (2nd cont.)	2	12	6
Berry, A. J.	2	2	0
Ewart, N. P.	2	2	0
Maney, W. S. & Son	2	2	0
Stewart-Wood, J. (2nd cont.)	2	2	0
Tinniswood, R. N.	2	2	0
Fell, H. H. (2nd cont.)	2	0	0
Menmuir, T. (2nd cont.)	2	0	0
Palmer, D. J.	2	0	0
Belcher, W. S.	1	1	0
Dodd, A. H.	1	1	0
Galbraith, C.	1	1	0
Jackson, R. L. O.	1	1	0
Steadman & Currie	1	1	0
Broadham Produce Ltd. (2nd cont.)	1	0	0
Calder, J.	1	0	0
Coates, H. T. (2nd cont.)	1	0	0
Gardner, R. W.	1	0	0
Gibbons, J. S. (2nd cont.)	1	0	0
Kilmahon Farmlands Ltd. (2nd cont.)	1	0	0
Sampson, S. (2nd cont.)	1	0	0
Scott, R. G.	1	0	0
Windsor, F. (2nd cont.)	1	0	0
Wright, C. W.	1	0	0
Young, J. B. & F. W. Ltd. (2nd cont.)	1	0	0
Turner, Col. W. A. (3rd cont.)	1	0	0
Atkins, P. C.		10	6
May & Baxter		7	6
TOTAL	£1,821	19	8

CROPS FROM SAWDUST

described by

Dr. KURT LOHWAG, of VIENNA
(Honorary Member of the M.G.A.)

Austria is situated in the middle of Europe and its capital, Vienna, is renowned throughout the world for its gay music. The whole country suffered very heavy damage during the last war, and among the major problems in 1945 was the nourishment of our people. For instance, the Government and many private institutions such as the Austrian Mycological Society tried to awaken interest in mushrooms as a food. Many lectures were given all over the country on the edible fungi which grow profusely in the Austrian forests and on harmful species too, for during the war there had been some severe poisonings.

At the present time it is possible to buy in the markets not only the cultivated *Champignon* but also about 50 other kinds of edible fungi. We have police lists of those which may be offered for sale. (At one period, however, the people became so keen on this additional source of food that none was available at the markets.) Cultivated mushrooms reached the principal market in Vienna -called the " Naschmarkt " —in 1948, and in all 2,282 lb. were sold. In 1949, this weight had leapt to 54,670 lb. The quantities sold in all the Viennese markets during the past few years were as follows : 1946 –1,200 lb. ; 1947—101,000 lb. ; 1948—1,313,200 lb. ; 1949—1,504,600 lb.

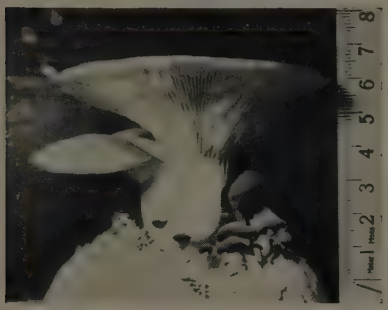
In the Naschmarkt in 1949, apart from the 54,670 lb. of cultivated mushrooms (*Psalliota campestris*), 22,200 lb. of honey mushrooms (*Armillaria mellea*), 426,620 lb. of chantarelles (*Chantarellus cibarius*) and 845,432 lb. of ceps (*Boletus edulis*) were sold. The proportions are probably similar in the other markets.

We have no Mushroom Growers' Association in Austria, and in consequence statistics are not available, but our growers had to face considerable difficulties after the war. There was no horse-manure immediately after 1945, and what there is to-day is scarce and costly. We are therefore considering the possibility of cultivating edible wood-rotting fungi. The basic medium is sawdust, of which we have plenty. We add 5% of an accelerator described by Badcock* as follows :

Maize meal, 50 parts by weight ; bone flour, 30 parts ; potato starch, 17 parts ; sucrose, 2 parts ; wood ash (from combustion of Scots Pine sapwood), 1 part.

*BADCOCK, E. C. (1941). New Methods for the Cultivation of Wood-rotting Fungi. Trans. Brit. Mycol. Soc., 25, 200-205.

One of the best fungi to grow by this method is the Oyster Mushroom (*Pleurotus ostreatus*).



The photograph seen here is of an Oyster Mushroom we cultivated in a small glass; the figures are centimetres. I am now trying to grow it on a larger scale. Besides this species, it should not be too difficult to grow on sawdust such wood-rotting fungi as the Velvet-footed Collybia (*Collybia velutipes*) and the Honey Mushroom already referred to. Similar experiments are being made in Germany, and in my opinion are worth trying elsewhere. You are very lucky in England to have a well-organized Mushroom Growers' Association and your well-known Research Station, whose work must be very much appreciated everywhere. Unfortunately we have no such institutions in Austria.

Mr. W. E. Shewell-Cooper, M.B.E., N.D.H., F.L.S., F.R.S.A., indefatigable Principal of the Horticultural Training Centre, has moved from Hextable, Kent, to a larger and more suitable estate in Thaxted, Essex. He was the first Educational/Advisory member to join the M.G.A., and we all wish him well at his new address.

Cold Storage : " Mushrooms are usually stored in chips at a temperature of 36° F. The humidity required is about 80% and storage is for a maximum of two weeks. The water content of mushrooms is about 88% and the specific heat 0·9 " (Letter passed to us by Maco Refrigeration & Electrical Co. Ltd., 205A King Street, Kettering, Northants., from Lightfoot Refrigeration Co. Ltd., Abbeydale Road, North Circular Road, Wembley, Middlesex.)

Additions to the Library : G. Borzini's Ricerche sullo *Psalliota campestris* Fr. e notizie sulla fungicoltura in Italia, presented by the Mushroom Research Association ; Mushroom News, Vol. 3, No. 2 (October 1950), presented by W. Darlington & Sons Ltd. ; Bulletin of the French M.G.A. (October 1950), presented by the French growers ; Dr. P. J. Bels's Enkele Problemen van de Champignonteelt, presented by the author.

Research Programme at Yaxley

Answers to Questionnaire reviewed by Dr. R. L. Edwards

With the approval of the M.R.A. Board, the Secretary of the M.G.A. recently sent to all members a questionnaire asking them to indicate those problems of growing, pests, and diseases, on which research could help on their farm. Members were also invited, if they wished, to show the order of importance of items marked. The replies may be taken as a fair survey of the mushroom growers' problems to-day, and I have been asked to discuss them.

It is common knowledge that there is always a time lag between a discovery and its application. Some interval is unavoidable, but in all spheres of agriculture and industry one of the urgent tasks to-day is to make it as short as possible. **The immediate universal application of all our present knowledge would greatly reduce losses due to pests and diseases, and so, without raising costs, increase output substantially.** For many growers the result would be an appreciable reduction in cost per pound of mushrooms.

To get this knowledge over to the grower so that he can use it calls for the thought and work of research workers, advisory officers, and growers themselves. Looking at it from the research worker's point of view one is very apt to think: "Well, that pest has been settled by Bugwash XYZ; we need not worry about that one any more," and go on to some other unsolved problem. One does not realise how many growers have never heard of Bugwash XYZ, and are still smothered with those pests—until answers to a questionnaire start coming in. 40% of growers answering this questionnaire had trouble with phorid and sciarid flies and springtails, all controllable in sound mushroom houses, growing on shelves, trays, or concrete floors, by suitable use of modern insecticides. A further 25% had other answerable problems, making **over 60% who can derive immediate benefit from results of research,** which they were not previously using. Even more striking—only one grower out of the 50 who indicated their problems cannot benefit either by advice based on past research or by the programme now in hand. *We hope that other growers who have not yet done so will complete this questionnaire, which is most helpful to us and may be to them.*

The following list gives the percentage of growers answering who marked each item as one on which research could help them on their own farms.

	%
Composting process	30
synthetic compost	34*
peak heating	24
all aspects together	52
Casing soil	56*
Watering	24
Ventilation	26
Pests.	
Phorid and Sciarid flies	26
Cecid larvae	14
Eelworms	14
Springtails	22
Mites	12
Total, one or more pests	50
Diseases.	
Verticillium	32
Mycogone	18
Dactylium	20
Bacterial Pit	24*
Bacterial Spot and Blotch	28
White Plaster Mould	14
Brown Plaster Mould	16
Verdigris (and mat disease)	30*
Truffle	18*
Fusarium	8
Red Geotrichum	6
Other diseases	2
Some disease, total	78
Various other problems	38

84% of the growers want research on one or more of the items marked * above, which are in the current programme of research.

The " various other problems " include :

the cause of flushes of small mushrooms
spawn
whether DDT really depresses the yield
stroma
economic cropping period
cleaning houses between crops
cleaning beds between flushes
composting machines
preservation of timber
whether general hygiene is overdone
site contamination

and some peculiar to individual farms.

In addition to the pests already mentioned which I really think can be completely controlled by BHC (and possibly by other insecticides) we have found that HETP is very effective against the common mushroom mite, although it may not kill all the wide range of species which are sometimes found. It is too early to express a definite opinion on that. B. D. Moreton also recommends BHC for control of two common species of mites.

We have still no answer to Cecid larvae and eelworms once they are in the bed.

Diseases

Taking into account also the relative importance given by some growers, the eleven diseases in the list come out in the following order :— *Verticillium* ; Verdigris (and mat disease) ; Bacterial Pit ; Bacterial Spot and Blotch ; *Dactylium* ; Truffle ; *Mycogone* ; Brown Plaster Mould ; Fusarium ; White Plaster Mould ; Red Geotrichum.

The use of disease-free casing soil, attention to general hygiene, and the early removal of any infected mushrooms can give a considerable degree of protection against *Verticillium* and *Mycogone*, and also *Dactylium*. *Mycogone* has been very successfully controlled by some new fungicides such as Parzate and Dithane Z.78, which are now being tested by arrangement between the suppliers, M.R.A., and certain growers.

Casing Soil

Two points emerge quite clearly from recent studies, mainly in other laboratories.

1. Water-holding capacity is very important.
2. Air must be able to pass freely through the soil.

It is also highly probable that the behaviour of any particular soil varies with conditions of air humidity and particularly temperature. As the temperature rises and humidity falls more exacting demands for water and air movement are made on the soil.

Other soil characteristics are probably important. What they are may be clearer when the effects of these two are better understood.

Ventilation has recently been studied privately by Dr. I. F. Storey and Mr. S. Middlebrook, and the air requirement of mushroom beds from the theoretical aspect has been studied at Yaxley.

The only attempt to study watering by quantitative methods seems to be that of Bulloch (M.G.A. Bulletin 16).

To summarise, the commonest pests can already be controlled. Of the seven commonest diseases, three are at least partly amenable to control, and three others are being studied at Yaxley.

Casing soil and compost are the two most urgent cultural problems. They also are being tackled.

NOTES FROM *Stanley Middlebrook's* DIARY

The following items appeared within a fortnight :—
From *Manchester Guardian :* " Was there ever a better year for fungi ? The long spell of wet weather has brought them up in thousands . . . . "
From *Manchester Evening News :* " Although field mushrooms usually thrive in damp weather, there is a poor crop this year ; so Manchester fruiterers are relying on the dearer cultivated variety."

According to " Spadeworker " in *East Kent Gazette*, mushrooms are not grown as extensively in this country as they should be. " When once their culture is understood," he says, " the care, trouble and expense necessary for producing good crops are small compared with the returns that can be obtained . . . . I would like to impress on the amateur that it is *not nearly as difficult* to grow mushrooms as it appears on paper." Several comments. True, good crops give good returns but (*a*) they *must be* good crops and (*b*) care, trouble and expense often produce bad crops. Would he dare to impress on the " professional " that they are easier to grow than the book says ? My impression is that they appear much *easier* to grow on paper than in fact. The commercial grower knows the truth : consistently good crops, which alone can show a profit, are very difficult to produce. Surely " Spadeworker's " operative words are " when once their culture is understood." What " professional " would dare to say he understood the culture ? Much less the amateur.

I have occasionally reported the " theft " of mushrooms by slugs, mice, and even young children who seem to prefer them in a raw state. The latest addition to the criminal gallery is our black cat who leaps up on to the packing shelf and with great relish vigorously reduces our sales.

A manure which must have been undercomposted produced masses of inkcaps on the top beds only. Production is poor in that house but the top beds are the best. Presumably moisture—resulting from condensation—is responsible for both fungi. May we assume from this that if a compost is known to be underdone it should be kept pretty wet to do any good ?

Annual General Luncheon and Meeting. I give my own personal opinion—in no way an official one—when I say I think this meeting has been disappointing. The lunch itself was good ; there was the usual *bonhomie* and goodwill, but the attendance was poor, not nearly good enough after five years. There was no fog excuse this year and everything was most adequately and efficiently organised. Absenteeism, to use a current word, could be applied to all Counties, but was most

marked in the case of Sussex. Why only four or five members from the largest mushroom growing area in the British Isles? So disheartening and discouraging. What is it? Apathy? If so, it's time to point out that the M.G.A. was formed for the benefit of growers and that a great deal has already been done for them. I venture to predict that before long a large number of members will be looking to the Association for further help with, shall we say, their fuel problems, and if things don't improve, with permits for this and that. Mushroom growing is less vulnerable than it was five or six years ago, thanks entirely to the Association, but the M.G.A.'s continued usefulness, particularly in times of emergency, depends on full support. Large-scale apathy or negative membership will undoubtedly lessen the fighting power of the M.G.A. and will inevitably react against every member. Can we not, on these few occasions when it is possible, demonstrate by force of numbers, the strength of a united industry? An 80%—100% attendance on such occasions would show the world that mushroom growers at least are prepared to use their full might to meet and grapple with any inimical emergency.

It's been a long and arduous journey from those days when the mushroom grower who dared to mention his occupation ran a grave risk of being put out of business for the duration, especially if he were unwise enough to imply that he grew food, to the present highly honourable—if jaunty—climax of a fourth leader in *The Times*, from which the following is extracted. " ' Not presume to dictate,' remarked Mr. Jingle, ' but broiled fowl and mushrooms—capital thing.' It is pleasant to find that although 133 years have since passed, his advice is not forgotten by those who must be the best judges. The Mushroom Growers' Association has just celebrated its fifth birthday by a *mushroom feast* and the main course appears to have been one of chicken and mushroom sauce." **A Refresher Course,** mooted by Mr. Atkins at the A.G.M., is to materialize very shortly in Peterborough. There is no truth in the allegation that this is to be an eating and drinking contest under the able instruction and at the personal expense of our Chairman.

" **Before long,** the country will face the stark necessity for extremely large-scale composting. It is a point which should be worrying the authorities far more than is apparent " (*Fruit Grower*). I said much the same in our first Bulletin way back in 1945. I said then that mushroom growers were not able to shelve the composting problem like other industries. It seems to me agriculture has kept it on the shelf too long. I would, however, ask the *Fruit Grower* who are the *authorities* who should be worrying?

The compost problem is becoming acute for us too. A regular supply I have had for 10 years has dried up. Until recently I was, I suppose, one of the lucky growers in this respect —plenty of first quality manure at very reasonable cost and regular as clockwork. Now I'm reduced to Racing stuff at high prices and the inconsistencies and uncertainties of delivery that attach to it. Horses are fast disappearing from the land. 55,000 disappeared from farms in 1949. There are now apparently only 396,000 on the land compared with 451,000 the previous year. In 1895 there were 1,337,905. So farms are down by about a million. I would

like to have comparative figures for the " Town horse " population.

As a result of the above, we may expect the suppliers of racing manure to pop up their prices. Our answer is to get down to synthetics. By all accounts the M.R.A. synthetic properly handled will equal normal manure composts in performance and at no greater initial cost. If the racing suppliers do not take undue advantage of the position we shall not need to boycott them, but if they do . . . . !

In my 26th August note I hoped our steam treatment against eelworm, itself an experiment, might work against mat disease. There are now indications from the first of these tests that it *has*. The first house peak heated by steam has been almost entirely clear of mat, only a few sq. inches having been found on the bottom bed which would, anyway, not get as hot as the others. This is the first " clean " one for months.

Keen observers will note that the following has nothing to do with mushrooms. It is from the journal *Taxation*. " In the Nuts (Unground) (Other Than Groundnuts) Order, the expression Nuts shall have reference to such nuts, other than groundnuts, as would, but for the amending order, not qualify as nuts (unground) (other than groundnuts) by reason of their being nuts (unground)."

The cultivated mushroom, says a writer, is perfect in form and cleanliness, but it does not possess the grand flavour of the wild species. How often do we hear this ! It may be true, but it is also beyond doubt that the flavour of the cultivated mushroom is more often than not *lost* in faulty cooking. With no other " vegetable " is precision cooking so necessary.

All the Research wallahs laugh me to scorn when I suggest that casing soil presents a mechanical rather than a biological or chemical problem. Consider : Soil x is known to be one of the best in the country. Those who use it get good crops. I get good crops with my soil. But when I try soil x against my own on the same compost I get mainly poor results. In a current test some of soil x was put on wet, the remainder dry. The " wet " area is producing pretty well, but not as well as my own soil. Yet the regular users of x put it on *dry* and don't water it for 8-10 days. So the same soil gives different results in different conditions (of air, humidity, etc.?). If I'd found soil x in a local field and tried it, I would have condemned it on all results I've had. Yet we *know* it produces well elsewhere, where presumably it is properly adapted to its environment. Nothing more, I submit, than the pure mechanics of the job. I suggest this applies to a wide range of soils.

The incidence of bazaars, fêtes, sales of work, whist drives (prizes), etc., is telling an increasing tale on the expense side of our balance sheet. These items seem to come in the general category of " outgoings." Taxes would appear to be similarly classified.

Having performed the passive rôle of a " waiting juryman " for 4 days and having observed the certain but often very slow course of justice, I imagine that if a certain case came before the judge the evidence for both prosecution and defence would be so voluminous, weighty, varied and conflicting, that a juryman would be called to serve for life. I refer, of course, to the case of Middlebrook v. Agaricus Campestris.

MY WAY OF GROWING

4 R. R. HOWSE, Nine Acre Farm, Codsall, Staffs.

During a recent visit to my farm Mr. Atkins suggested an article under the above heading. It is always difficult for the smaller grower, usually only too aware of the shortcomings of his establishment, to write an article which he knows will be read by growers not with farms larger in size but also with far greater experience than himself. This article, however, may contain a few ideas, or warnings, for the smaller growers like myself whose problems are not always the same as the larger growers.

Houses. I started my building just over two years ago, using plain curved asbestos cement sheets for the roofing, and hollow concrete blocks for the ends and side walls. I was fortunate in obtaining enough sheets for my first two huts from disposal sources, but these had to be dismantled on their old sites and I have rather painful memories of undoing the wrong nuts first and finding myself on the floor with the last six sheets on top of me ! The sheets for the other two huts were obtained through normal trade channels and they are, in my belief, the cheapest practical huts that can be built. The sheets were erected to form a double roof with 2" of Fibreglass between the sheets. I must say I have been more than satisfied with the insulating properties of the houses up to the present. Ventilator inlets were built at the rear of the houses with 6" extractor fans at the top of the front walls. Without being able to say why, I do not like using the fans, but prefer now to open the door of the houses and fit mesh screens into the openings when ventilating. This is **always** done after watering a house.

Composting. All our composting is done in the open on a large concrete slab. The stack is never covered. It is a surprising fact that most of the difficulty of composting in the open comes from the drying

effect of wind and sun ; rain seems to have very little effect on the stack, only on the morale of the turners ! I may add that the turning is done in the open through necessity, not preference.

Peak Heating. The biggest problem has always been ensuring a good peak heat, the hot water heating system being unable to ensure the temperatures necessary. Expensive steam apparatus was obviously out of the question, but I have recently tried a " Baxi " Hot Air Stove, an ordinary coke stove that distributes hot air without fumes. I have placed it in a wheeled trolley to make it portable, and roughly the procedure is this :—A hole is cut in the roof in the centre of the house to take the asbestos cement chimney (this is not permanently fixed). The stove is lit before the filling of the house has been completed to ensure that it is really hot when it is taken in.

When the house has been cleaned up the " Baxi " is wheeled in and the chimney is placed in position. A fan is placed on the floor approximately 18" behind the stove at an angle of 45° so that it is blowing against the back of the stove.

I have only had one opportunity of testing this method up to yet with the following results :—Third day after filling—Floor Temperature 116° F., Bottom Bed 123° F., Top Bed 128° F. The stove was allowed to burn out on the third day as the bottom bed had been over 120° F. for more than twelve hours.

It is naturally impossible to say definitely after only one showing whether this is the smaller growers' peak-heating answer, but I do feel that it will solve **my** problems. *Advantages :* Inexpensive first cost, mobile, assists peak heating for a few shillings worth of coke. (In my case one wheelbarrow full.) *Disadvantages :* It has to be stoked night and morning. One last point may be of interest. Despite the fact that I did not place any protecting screens between the stove and the beds there was very little drying out ; even the beds which were less than one foot away only dried out on the top layer. This I believe was caused by the cold air being blown by the fan at the stove and minimising side heating.

Disease : I have been very fortunate in only having three semi-serious outbreaks of disease, all *Verticillium*. The first two houses were affected after about six weeks cropping. The beds were picked clean and watered with a 1-1-50 Bordeaux at approximately 35 gallons per 1,000 square feet. Cropping was delayed a week in both cases, but the next flushes came up with only the odd mushroom infected. These were sprayed with 2% formaldehyde and removed during the normal routine cleaning. It may be of interest to note that in both cases the houses

seem to have benefited by either the spraying or the week's rest, for cropping improved after treatment. The third house was infected from the start with practically every mushroom spotted. This happened at a time when, despite all efforts, I was unable to obtain any Copper Sulphate so, in my desperation to kill or cure, I gassed the house with formaldehyde (1 qt. to 1,000 cubic feet) and waited—somewhat anxiously, I must confess. Mushrooms started to appear again after 8 days and flushes seemed to improve as time went by. The house produced 1 lb. per square foot and, although this is not a very good yield, the mushrooms following the treatment were all clean and the spotting vanished, and the final result was not too heavy a price to pay considering it eliminated the disease.

I would advise all growers to keep a good look out for **" Mummy."** I ignored the first obvious tilted caps and stunted growths until one whole shelf was infected. It is very easy to mistake " Mummy " for the odd stunted mushrooms that always seem to come up with good flushes, but I believe if it gets a hold it spreads faster than the 6" a day stated in the textbooks.

One last word, if I may, to those just starting growing. Do build the houses yourself ! Concrete blocks are not difficult to lay, and the saving in expense between doing it yourself and having a builder do it is terrific, besides which, you would be surprised the number of ideas that occur for future application when you are actually building—the ventilator inlets, for instance.

To close (Editor permitting), regards to my many friends at Lindfield Mushrooms Ltd., who taught me how to turn " 'orse dung," and that is, after all, what really matters.

Professor H. Paludan discusses . . . . .

Mushroom Difficulties in Denmark

Their influence on cultivation

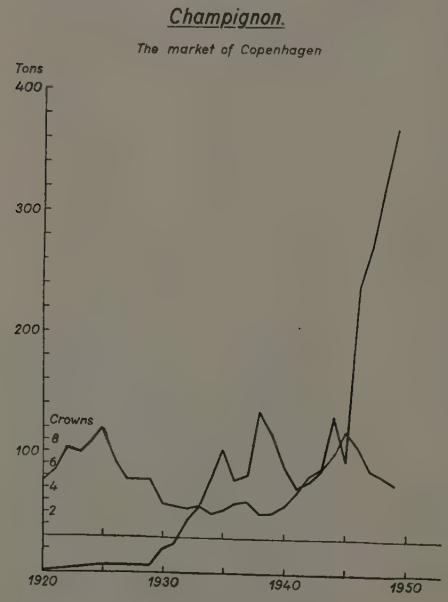
The cultivation of mushrooms in Denmark probably began in the middle of the 18th century. It was learned in France and carried out at the Manor Houses in the country, usually in a mushroom cellar. The mycelium was taken from old beds and cleanliness and ventilation were ignored. At first growers sometimes succeeded, but they usually failed later and gradually mushroom growing was abandoned.

The general uncertainty of the culture and the increasing import of French mushroom-conserves stopped the culture and the consumers got out of the habit of using mushrooms –by the way, mushrooms were mostly only used together with boiled hens, in the mushroom sauce, where one had to look very carefully to find any. And when the market gardeners about 100 years ago took charge of the private gardeners' failure, nobody thought of cultivating mushrooms.

A radical change took place when the first American bottle-myceliums were introduced in 1928 from Lambert. The following October, one of our market gardeners laid out culture beds in no less than six cucumber houses, and about Christmas the first mushrooms appeared —but could not be sold, customers being used to buying canned mush-rooms at the grocers, whereas the greengrocers scarcely knew nor

wanted to keep the fresh product. Through advertising, propaganda, low price, and information about the many ways of using mushrooms in the household, they changed from a luxury into an article normally used and generally appreciated.

Until 1929 the supply was very small, but the price was high, 8 Danish crowns per kilogram. Then increasing supplies and the limited consumption resulted in decreasing prices, down to two and a half Danish crowns per kilogram. Of course it did not give a big profit, but the low prices widened the circle of consumers. Imports of canned mushrooms, which before 1930 totalled about 300,000 Danish crowns a year, ceased. At this time the mushroom supply to the market was not always sold.



In 1935 the growers united in a Growers' Association which among other things worked for the establishment of a special mushroom cannery.

The Danish market of to-day is mainly supplied by fresh mushrooms, which we always tell our customers are the most delicate, and during 1947 we exported 20,000 kg., worth 154,000 Danish crowns. Most of them went to Sweden, but also to Egypt, Ceylon, East Africa and Central America.

In 1935 production reached a maximum and the price was down to 2·27 Danish crowns per kilogram—but this was not the only cause of the decrease in supplies.

New cultivators mostly succeed the first year, next year they do tolerably well, but the third year they fail—and the cause is then to be found in growing carelessness, especially in regard to cleanliness, and insects and other noxious elements.

Whereas the culture in the old mushroom cellars, which were in use year by year, often suffered catastrophic attacks of Mycogone, the American strains now coming into use appeared nearly resistant to this disease—and this fact together with the rotation of crops which the Danish gardeners soon carried out, rescued us from this destructive attack.

Until now only one mushroom house of the American type has been built in Denmark, and this house is not used any more, but we make use of our normal greenhouses during the winter season, the glass being covered by straw. Usually there are sufficiently good ventilation and heating equipment, and the five months of the mushroom culture fit in well with the seven month culture of tomatoes and cucumbers. And by using new and clean houses each year, re-infection of the cultures is avoided.

During the summertime empty stables or barns are used ; they are usually constructed with good ventilation—but if that is not the case, air-conditioning installations are made, often in connection with a moist chamber. Especially during the years of German occupation, when the stables were empty, many farmers started mushroom growing here, frequently with great success, as the stables were uninfected and the market ready ; mushrooms were free from price-regulation and the customers had scarcely anything else to buy, with only Danish tobacco, no chocolate and very little meat.

The first technical cause of a decrease of the production was attack by fungus gnats (*Sciara*) and manure flies (*Aphiochaeta*). At first the grower only saw single insects, and he had no idea of controlling them, but when the catastrophe developed, the beds were heaped with Pyrethrum, Derris, Nicotine powder, but of course too late and in vain.

The appearance of the DDT products now means nearly total security ; no far-sighted cultivator to-day neglects to powder his beds immediately after they have been laid.

The next attack which reduced production came from Springtails (*Collembolae*). The cultivator grew careless in the way he fermented the manure. The composting place was not cleaned, the manure was not turned carefully enough so that it would reach the temperature of 130° F., or mouldy straw or chaff was used. And meanwhile the gnats and flies like " air-lines " carried the Springtails from one part of the house to the other.

These often totally destructive attacks taught the cultivator a more thorough preventive cleanliness and a more careful fermentation of the manure. In addition the beds are powdered with Lethane B.71 before casing with soil.

Together with the attacks by springtails the severe attacks of mites, which in the same way as the springtails live inside the bed, where the grower cannot get at them without disturbing the mycelium at the same time, taught him that prevention is far better than cure, and as a precaution against mites we burn sulphur, 80 grams per cubic meter.

Scarcely had the growers learned how to prevent both springtails and mites, when they fell into the opposite ditch. Fearing these noxious animals they continued the fermentation for so long that the manure suffered a great loss of dry matter and nitrogen, and also its ability to re-heat when the beds had been laid—with the result that white plaster mould occupied the compost and hindered the spawn run.

This attack from plaster mould was so severe, that many growers gave up mushrooms, and the total production was nearly halved, whereas the price went up to 4·16 Danish crowns per kg. This was in

1941, but still there was a faithful staff of cultivators, who learned from the defeats and difficulties how to combine a careful fermentation with a quick one, and the curve of supply from 1942 and onwards rose steadily in spite of the war. Also the price curve rose reaching its maximum in 1945 at 8·91 Danish crowns on an average.

I have no doubt that however nice it is for the cultivator to get high prices they are very undesirable as such, as many people who have learned to appreciate mushrooms are prevented by the high price level from buying. They become an article of luxury again and a long time passes before people venture to ask for mushrooms.

After the war had finished, the stables were not yet in their normal use, and most articles were either still under price regulation or impossible to get hold of. The mushroom supply therefore rose as never before ; the prices were a little lower, but the canneries took the surplus production.

In Denmark fresh mushrooms are now available all the year round, and we have passed through all the difficulties mentioned, but thereby we have learned still better preparation of the manure, more thorough cleanliness, and how to make use of still more effective insecticides, etc. Now we try to present the market product as clean and durable as possible, an article of luxury in the everyday household.

Reprinted with acknowledgement to the Review of Applied Mycology, XXIX, 8 (1950)

SOIL RESEARCH IN ITALY*

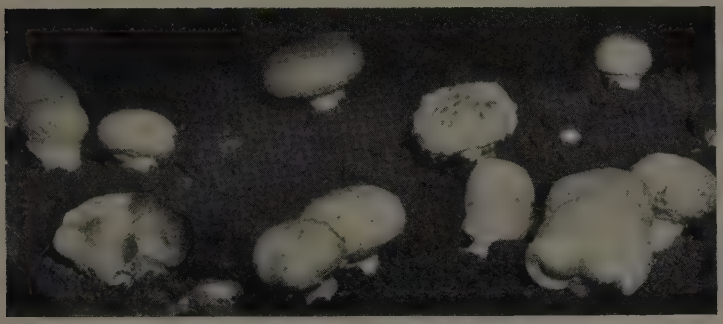
In experiments carried out at the Italian Cryptogamic Laboratory, Pavia, mycelium of the " Bianco 312 " race of mushroom (Psalliota campestris) cultivated in Italy was grown from spores in an artificial compost in bottles, and half used for inoculating compost in cylindrical pots. These were covered with 1·5 cm. of the casing soils (R.A.M., 27, p. 61) under test, which were obtained from different parts of Italy. Distilled water was added until it penetrated to the mycelium, further water being added periodically to standardize the soil humidity. The bottles containing the rest of the mycelium were maintained at 16° C. at 90 per cent. relative humidity for about 20 days and finally at 11° to 12° and 90 and 92 per cent. relative humidity. The mycelium was then added to the pots on top of the casing soil.

The mycelium spread with ease through all the soils tested, although more slowly in soils which had a rather high calcium content. The factors promoting rhizomorph formation are not necessarily the same as those promoting the production of mushrooms.

From the results the principal casing soils used by Italian mushroom growers appear to be (*a*) those inducing rapid rhizomorph and mushroom formation, (*b*) sandy soils which have a similar effect but the production of fruiting body initials is not followed by their appearance in a more or less developed condition, and (*c*) those which under the conditions of the experiment did not stimulate the production of rhizomorphs, fruiting body initials, or mushrooms. These last-named were a highly calcareous soil and sterilized siliceous sand.

*BORZINI, G. Ricerche sperimentali sulle terre usate in Italia per il ricoprimento dei " letti " di coltura di Psalliota spp. (Experiments on the soil used in Italy for the casing of culture beds of Psalliota spp.) Ann. Sper. agr., N.S., 3, 5, pp. 1111-1124, 2 figs. 1949 (English summary).

Creosote CAN be Dangerous



Especially with Trays

Several growers have complained recently of devastating malformations resulting from dipping or brushing their trays with creosote. We have been unable to discover why this damage should suddenly appear, but we understand there have been certain post-war changes in refining practice, and growers are advised to ask for a high-quality creosote, such as " BSS.144."

We consulted Dr. James W. Sinden, Professor of Botany at Pennsylvania State College, and he writes :—

" Creosote is a very tricky substance for treating shelves or trays. Apparently the material itself varies in the amount of the injurious ingredient it contains. Then the temperature and the length of weathering after treatment have much to do with the injury. If there is a tendency to crowd too many trays into a room that will also aggravate the situation. I have treated my trays with pure gas tar cut with one-third gasoline, and after six weeks weathering there was no injury to the crop grown in them. This is an English recommendation and I have found that it preserved the trays very well. Some treated 12 years ago are still in perfect condition. They have had no treatments since—merely being brushed out between crops."

WORKERS' WAGES

These minimum wages for agricultural workers (including mushroom-farm workers) came into force on 12th November, 1950 :

Male workers over 21, £5 a week (an increase of 6s.) ; women, £3 16s. 0d. (5s. extra) ; part-time and casual, 2s. 2d. an hour for men, 1s. 7d. for women ; overtime, 2s. 8d. and 2s. an hour respectively ; Saturday afternoon, Sundays and public holidays, 3s. 2d. an hour and 2s. 5d. an hour respectively ; proportional increases for juniors

Cuttings from the Kennett Square, Pennsylvania, News and Advertiser, 1950.

U.S. GROWERS ALARMED
Torquay Conference may mean Disaster

"AMI" National Association Formed

30th June. The American mushroom industry is alarmed. Cause for the alarm is the conviction among industry leaders that the present Administration in Washington, D.C., feels that the mushroom industry is one of the smaller American industries that have been labelled "expendable." They fear the present low tariff on mushroom imports to the United States may be lowered even further at the foreign trades agreement discussion which this country will begin with other countries at Torquay, England, in late September. Canned mushrooms are listed as one of the items to be considered at those trade treaty talks, and industry leaders feel that their only weapon now to escape further great injury to the industry through lower tariff concessions is a letter-writing campaign which may influence prominent Administration supporters towards urging removal of mushrooms from the list of treaty discussion . . . . .

The Tariff Act of 1930 as it affected imported canned mushrooms was 45 per cent. of the invoiced value (*ad valorem*) and 10 cents per pound on drained weight. The Reciprocal Trade Treaty Act of 1934 provided for a 50 per cent. variance from this figure, at the authority of the President, but they have never varied except downward. The 1936 trade agreement with France—until recently the country which has been the main importer of canned mushrooms into the United States—reduced the *ad valorem* to 25 per cent. and the rate to 8 cents per pound. They were further reduced to 15 per cent *ad valorem* and 5 cents per pound on 1st January, 1948. Now, leaders in the American industry fear even further reductions, thinking that the Administration has in mind lowering the tariff on canned mushrooms to 12½ per cent. *ad valorem* and 4 cents per pound . . . . .

The brief sums up the American industry's tariff views, in part, as follows :—

1. "During the past year it has become apparent that the American market for fresh mushrooms, canned mushrooms and mushroom soup will not absorb the recent rate of American production of approximately 63,000,000 pounds per year . . . . . It is anticipated that plans for the curtailment of production will be placed in effect before the next heavy producing season beginning in October, 1950."
2. "Prices received by mushroom growers in recent years and particularly during the past year have declined precipitately and are now somewhat below production costs. Even without any increased imports the domestic industry is faced with the absolute necessity of substantially reducing production and employment. Any increase in imports will only increase the extent to which production and employment in the American mushroom industry will have to be decreased."

3. " The industry urges that canned mushrooms be deleted from the General Agreement on Tariffs and that no concession thereon be made in these negotiations, thereby permitting the tariffs to revert to their 1930 level."

Although the tariff concessions have been made primarily at the request of the industry in France, since World War II it has been of greatest benefit to Japan, which has been the chief importer of canned mushrooms since 1948. In 1949, imports of Japanese canned mushrooms to the United States totalled 256,191 pounds, nearly three times the 1948 figure and more than twice the import from France.

W. Howard Green, who recently visited the mushroom industry in France, Belgium and England, reports that the industry there is very well informed. Most of the mushrooms in France and Belgium are grown in limestone caves where construction costs are nil and there is no cooling expense in a year-round growing season. The English climate also is favourable to year-round growing without cooling. He said that there was almost unlimited opportunity for growing expansion there, estimated that there was 1,500 acres of such growing space now unused in Belgium and " ten times that much in France."

Marshall Plan funds will send French experts to America to study the American mushroom industry and incorporation of some American methods might help increase the French production in their present space.

28th July. A lot of people seem to be writing to their representatives in Congress concerning the tariff on imported canned mushrooms . . . . . The letter-writers have been particularly prolific in Coatesville and West Chester, it is understood . . . . . There still is time to write that letter to the Congressman, to let him know that the people in this Mushroom Capital of the World don't want the mushroom industry wiped out by low tariff barriers. Who should write the letters ? Well, the mushroom grower should. Otherwise, the continuance of the present low import tariff may put him out of business. The mushroom worker and all members of his family certainly should. He may have to look for other employment if French and Japanese-canned mushrooms continue streaming into American markets at prices lower than the cost of the American-grown product. The local merchant and business man certainly should be interested in the prospects of the death of the largest local industry which makes the community so prosperous. Killing the American mushroom industry won't aid the prosperity of the foreign mushroom community as much as it will lower the prosperity of the American community.

1st September. The fight to save this country's mushroom industry is not yet over . . . . . A week ago, members of the Kennett Square Chamber of Commerce heard Walter Maule, a member of the Mushroom Tariff Committee, discuss the situation facing the mushroom industry and agreed to sponsor more letter-writing by borough residents on behalf of the industry. The Mushroom Tariff Committee estimates that about 5,000 letters have been posted in this growing area since early July and that this avalanche of sentiment on behalf of the mushroom industry is being recognized by the Congressman who have received the mail.

22nd September. The first steps in organizing The American Mushroom

Industry were taken at the Avondale Fire Hall, Wednesday evening, when more than 100 growers, canners and others in the industry attended a meeting called by a 17-member committee elected at an April meeting. By-laws prepared by the committee and read by the temporary chairman, John DiCecco, were adopted without dissent . . . . .

With Arnold Saverioni, of Kennett Square, acting as secretary of the Meeting, 35 directors of The American Mushroom Industry were elected . . . . . (among them being Walter Maule, of the M.G.A., J. B. Swayne, Jnr., of the Swayne cannery; Louis Lescarboura, of the Lescarboura cannery; Lawrence Swayne, spawn representative).

DiCecco explained that the organization would not begin its chief function—that of sponsoring a nationwide advertising and publicity campaign for the use of cultivated mushrooms—until membership dues had brought 25,000 dollars into the treasury. In case dues do not total 25,000 dollars, the dues will be refunded and the advertising plans will be dropped. (The by-laws provide for definite assessments from members. For growers, this will be one-fourth of one cent per square foot of growing space per year, or about 20 dollars per double mushroom house. Others in the industry will be assessed a minimum of 60 dollars or a maximum of 600 dollars, depending on the decision of the board of directors.)

"I believe the whole industry is co-operating," said DiCecco. "It is especially good to see the canners coming along and there are many possibilities of service once we get organized." Among these "possibilities" he mentioned the need for a mushroom research laboratory in this vicinity and the hope that an organized industry could better seek government help to establish a laboratory to study diseases and problems of the industry.

The M.G.A. of Great Britain and Northern Ireland congratulates AMI on this major step and wishes it every success.

Mr. J. E. R. SIMONS, of Natts Farm, Harlow, Essex, brings to the Executive Committee long experience in administrative work coupled with considerable practical experience of growing mushrooms and marketing them. In 1923 he joined the staff of Murphy & Son Ltd. (now the Murphy Chemical Co. Ltd.) and three years later went to Geo. Monro Ltd., being appointed Sales Manager in 1933. He has now taken over the sales of Mount Spawn. He has served for many years on the Executive Committee of British Insecticides Manufacturers and on the Council of the Horticultural Fertilizers Association, and was an original member of the Committee of the Industrial Pest Control Association. He is particularly interested in packing and packages, several innovations during the past 20 years being based on his ideas. Last year he was a Member of the M.G.A.'s Publicity Committee.

ITEMS OF INTEREST

Ministry of Agriculture **Bulletin 34 :** " Mushrooms Growing," is now available price 3s. 6d. (3s. 9d.) from H.M. Stationery Office, P.O. Box No. 569, London, S.E.1. It will be reviewed in the next M.G.A. Bulletin by Mr. Stanley Middlebrook.

Dr. John Ramsbottom, Keeper of Botany at the British Museum and a great advocate of the pleasure to be found in eating mushrooms, retired in October and has been succeeded by Dr. George Taylor.

Mr. John Hensley has been appointed head of the Horticulture Division of the Ministry of Agriculture. He takes the place of Dr. V. E. Wilkins, who was Guest of Honour at the first M.G.A. Luncheon at the Holborn Restaurant in 1946.

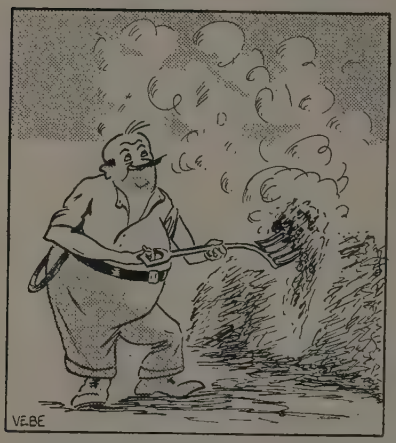
MEMBERS' CHANGES OF ADDRESS

•Brook, D.	South Drove House, Spalding Common, Spalding	Lincs.
Cooper, N. R.	Shadowlawn Products, Kimcote, Rugby	Warwicks.
Fell, N. W.	c/o Bank of Australasia, Melbourne	Australia
McGredy, Sml.	Royal Nurseries, Portadown	N. Ireland
Page, H. B.	Melchett Court Lodge, Sherfield English	Hants.
•Reeve, Eldrow	Box 215, West Chicago, Illinois	U.S.A.
Simons, J. E. R.	Natts Farm, Potter Street, Harlow	Essex
Westin, Gunnar	A'B Alimenta, Gyllenkrooksgatan 19, Gothenburg	Sweden

It was a great shock to hear of the death, on 17th October, of **Percy Major.** He was perhaps best known as our first M.G.A. Treasurer, in which capacity he served most efficiently. It is no exaggeration to say we could not have chosen better. But for those of us who have known him intimately and worked closely with him it is rather as a man that his passing is regretted. We shall never forget his generosity, his hospitality, his thorough attention to detail, and most of all that famous smile that inevitably accompanied any test of his powers of invention. His steady confidence and his immense application of his best efforts to the solution of our problems are greatly missed. He was highly respected and loved by us all.

OUR GEORGE

By courtesy of "The Grower," with many thanks to VEBE for much laughter.



"Four pounds a foot, at five bob a pound, would just about make 'im 'appy again." (7.10.50)

"Don't blow on 'em, dirty! Rub 'em on yer sleeve!" (10.12.49)

"The boss 'as bin readin' one of them books on mushroom pest control." (27.11.48)

"The boss wants ter try the tray system, so all you gotter do is rip out all these 'ere shelves!" (22.4.50)

Mr. Per Hjort, of Billingstad, writes on .....

Norwegian Mushroom Growing

I should long ago have written and expressed my gratitude for membership of the M.G.A. ; I very much enjoy reading the Bulletin. After a couple of years as an amateur grower, I was in the beginning of '49 co-operative in starting a mushroom farm on a commercial scale. I should add that here in Norway mushroom growing is a practically undeveloped field ; besides our firm, two or three others started at about the same time.

The first-mentioned firm, in which I am now the technical leader, is called " Norsk Champignon " ; it is situated on a farm in the outskirts of Oslo, Wollebekk, the owner of which, Mr. Carl Nielsen, went in for using some suitable localities for mushroom growing. As an expert adviser we had an elderly, experienced Danish grower, Mr. Reffstrup, who spent most of the summer with us, rendering extremely good service. Our production in '49 amounted to about 12,000 lb. Part of the mushrooms are grown in electrically-heated rooms for all-year production, part in straw huts designed for summer cropping. Two of these summer houses were laid too late in the summer to come into production, but had a good run of the spawn, so we let the beds freeze down. The same was done with a half-cropped house and, as far as we can see now, they have all stood the hibernation well, the mycelium looking very fresh and fine.

The indoor rooms are heated by means of electric cables. We are, however, still experimenting to find the best system, or arrangement, of these—we aim at a means of air-conditioning at the same time. If we come to a really satisfactory design, as I hope we soon do, I would be glad to report on it in your Bulletin.

This year we are busy increasing our growing area with some new permanent rooms, and a composting shed is to be built : outdoor composting in the Norwegian climate is extremely inconvenient.

As to myself, the M.G.A. Bulletin is my best source of inspiration. It always throws light on some of the most important problems—and as soon as one number is perused, I start looking forward to the next ! I am very impressed by the frankness in discussing problems and publishing results : of course such frankness may involve drawbacks (I am thinking about Mr. Boulanger's complaint a year ago), but I do think it will be advantageous in the long run. For instance, I regard it in this light, that if I should invent or learn of some novelty in design or method, then the best thing I could do with it would be to write about it in the Bulletin. Then I would have the opportunity of getting the matter discussed openly, and the chances for further improvements would be immensely increased.

In our firm we have, from the beginning, welcomed visits from other growers and this " open-door policy " has on more than one occasion lead to valuable mutual aid.

I would like to add that last summer I had a very pleasant visit from Mrs. Bels-Koning, of Holland. I am very thankful to her for advising me to become a member of the M.G.A. !

CORRESPONDENCE

I get more than value from your **excellent publications.** Many thanks! H. W. ABBIS.

Early this year I was in the intensive mushroom growing district of West Chester County, **Pennsylvania,** and there I met many mushroom growers and research workers. They were nearly always very favourably impressed by reports from Yaxley and thought what a very fine thing it was. I did get an opinion expressed to me that it would be a good thing if the American Mushroom Growers would do something similar . . . . . Compared with our prices and costs, the American growers are working on a very small margin and, if producing on any scale, they are very much at the mercy of the canners, as the bulk of the crop has to be canned, this being the only way mushrooms can be transported over long distances and into areas of a hot climate. A. J. WILLS.

The principal concern of the growers here (in the United States) is the danger of **French importation,** to be limited by continuation of the tariff, and the over-production at certain seasons here. The tendency to refill their plants or grow two crops a year has made a bad double peak in the production curve, one in the fall and one in the spring. As a result, this spring the price declined to 21 cents per pound and many growers lost money on their spring crops. Natural reluctance to repeat such a loss on the part of the affected growers will correct the condition without resort to artificial controls. Still, the problem is acute and the growers are much concerned. Since writing, the Korean war has boosted prices and developed a brisk market. Dr. J. W. SINDEN.

Can you tell me of anyone who has used **Phomene** (made by Pyrene) mixed with cement and laid on the outside of Handcraft Huts for ventilation, and **Vermiculite** applied in the same way?
RAYMOND THOMPSON.

As supply and demand rule every time, why not have a **factory for canning** mushrooms? JOHN BEVERIDGE.

Would you inform me where we can obtain Johnson's Comparator Test Books for **pH** ranges, mentioned by S. Burrows in the M.R.A. Report for 1949? F. W. BATEMAN.

(Editor: Standley Belcher & Mason Ltd., Church Street, Birmingham 3).

Red Geotrichum: I think *Sporendonema* is definitely a problem in those plants where it occurs. We have been making extensive temperature studies of the survival of various fungi invading mushroom beds, among them *Sporendonema.* Under moist conditions, soil containing this fungus can be freed of all infestation by heating to 62° C. (144° F.) for one half-hour. It is practically all killed at 55° C. (131° F.) by heating for 36 hours. This means that growers who steam their soil and pasteurize their houses and still have serious amounts of *Sporendonema* are allowing to occur re-infection from some outside source, the environs of their houses or perhaps the walks and floor inside. Dr. J. W. SINDEN.

Fred. C. Atkins Thinking it Over . . . . .

DELECTABLE DELICACY

The Cultivated Mushroom, wrote William Cobbett just over 100 years ago, " is scarcely ever seen in any gardens but those of noblemen or gentlemen of fortune." He ate some once, he confides, and it was not long before his " whole body, face, hands and all, was covered with red spots or pimples . . . . . " And he ends with this profound comment : *" Therefore I do no advise anyone to cultivate these things."*

But times have altered. " These things " have been in great demand for many years now, and the grower has adopted a more sensible attitude. " If the courageous public wants mushrooms," we say, " it is our duty to provide them." For ourselves, we are frequently heard admitting " we eat very few," or " You soon get tired of them, you know," or (boastfully) " I see them every day, and don't want them at meal-times too."

But what a dis-service we do ourselves when we talk like this ! Let us treat our friends when they come to dinner to new and succulent mushroom dishes. Let us say, in conversation here and there, that of the many difficulties encountered in mushroom growing, none is so serious as the irresistible proclivity to consume our profits, like the bibulous innkeeper ! Let us think up a slogan : Mushrooms Make a Meal—something more snappy and more telling than that, of course, but you see what I mean.

We ought to tell the world there are many other ways of preparing mushrooms than " on toast " or " with bacon." And who better than André Simon, president of the Wine and Food Society, who informed the National Press at our Annual Lunch that mushrooms were not only a condiment with food value but the ideal companion for wines red and white ?

I had the good fortune to sit beside M. Simon at that Lunch, and I mentioned the need for a book of Mushroom Recipes. He talked over the idea with the Wine and Food Society, and as a result they are to publish such a book in the Spring.

I am to write a brief introduction, and M. Simon himself is to discuss the gastronomic aspects. The recipes themselves will be divided into four sections—Mushrooms for Breakfast, Lunch, Dinner and Supper. The price will be about 5/-, and we are hoping it will appear on 3rd May, so that it may be launched at the Research Open Day.

You want to increase the demand for mushrooms ? Then buy a copy for yourself—and copies for your friends. What a happy birthday present ! And what splendid publicity for us all, under the Wine and Food Society's imprint.

The M.G.A. is purchasing a substantial number of these books for re-sale to members. Secretary Watson is already booking orders !

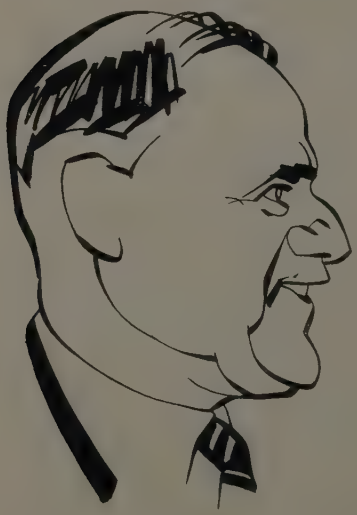
THE CHARM OF

ANDRÉ SIMON at Annual Lunch

"Tell the Housewife!" says Lady Leese

MONSIEUR ANDRÉ L. SIMON, DISTINGUISHED PRESIDENT OF THE WINE AND FOOD SOCIETY, WAS THE GUEST OF HONOUR AT THE FIFTH ANNUAL LUNCHEON OF THE MUSHROOM GROWERS' ASSOCIATION, HELD AT THE CONNAUGHT ROOMS, LONDON, ON WEDNESDAY, 4th OCTOBER, 1950.

Among the other guests were Lady Leese, who expressed the company's thanks to M. Simon ; Mr. C. E. Hudson, Horticultural Head of the N.A.A.S. ; Mr. E. H. Gardener, Chairman of the N.F.U. Central Horticultural Committee and the National Market Produce Show Society ; Mr. H. R. Haynes, N.F.U. Horticultural Secretary ; Mr. G. Samuel, of the Agricultural Research Council ; Mr. C. Morley Davies, Secretary of the Agricultural Improvement Council ; Mr. A. T. Brooke of the Ministry of Agriculture ; Mr. W. C. Moore, Director of the Ministry's Plant Pathology Laboratory ; Mr. H. H. Glasscock, N.A.A.S. Plant Pathologist, Wye ; Mr. G. Waterman, Secretary of the Worthing and West Sussex Growers ; Mr. Oliver Robinson, Editor of *"Good Housekeeping"* ; Dr. W. M. Ware, Life Honorary Member of the M.G.A. ; and Mr. A. S. Maney, printer of the M.G.A. Bulletin.



Mr. Arthur DeB. Hovell, Chairman of the M.G.A., who presided, extended a warm welcome to M. Simon. "As mushroom growers, we owe much to those who are interested in seeing our products reach the tables of the nation in an appetising and palatable manner," he said. "Although we may pride ourselves on growing mushrooms, domestic science is required before mushrooms can be termed 'delicious.' M. Simon is known throughout the world for his knowledge of good food and wine, and the objects of the Society over which he presides are to raise the standards of cooking. That has very far-reaching results, for not only does the visitor to these islands have much happier recollections

of our culinary art, but we have the satisfaction of knowing that our mushrooms are going to be appreciated by more and more people each year."

M. Simon said how much he had enjoyed the Mushroom Lunch, with very little mushroom in the first course (only just discovered at the end), a much more liberal supply with the chicken, and finally a good "mushroom on toast." It reminded him of a dinner he was given soon after his book, *The Art of Good Living*, had been published some 20 years ago. It started with mushroom soup, then mushrooms with the fish and meat ; there were no mushrooms with the sweet, but they came again with a savoury on toast. He said to his host, Maurice Healy : "I did not know you were so keen on mushrooms." Healy replied : "No, but you are, for on page 66 of your book you say you like mushrooms!" (laughter).

"He was perfectly right, and I will tell you why I like mushrooms," said M. Simon. "I like them because they have a very nice flavour, which is not obtrusive, possessive or aggressive, like mint, for example, which is deadly to a very good friend I have had all my life—good wine. I always look upon food as a partner to wine, and **mushrooms are an adequate partner for any wine, red or white, simply because their flavour is discreet.** Anything which jumps at you is merely vulgar, and there is nothing vulgar in the charm of mushrooms. That is why in the classical cookery books mushrooms are put down as condiments. Most condiments have no food value at all. Salt has no vitamins or calories, no food value, yet we cannot do without it ; without salt, other foods which have vitamins and calories have no appeal to us. In the classical cookery books **mushrooms are put among the condiments, but they are condiments with a food value.** It was found out during the war that this was so, when a great many wretched people who had to hide in the woods were kept alive on the mushrooms they could find.

"So mushrooms are both a condiment which adds to the palatability and pleasure of other foods, and also a food, because they have vitamins in their make-up and calorie value as well. It may be said that a condiment is like a staircase

which leads you to a meal, while the mushroom, being a condiment with food value, is like a moving staircase which carries you gloriously through the meal.

"So I am all for mushrooms and for getting people to eat more mushrooms, because they will enjoy their meals better. There is only one snag, as I see it. Most people these days are so taxed—they are taxed out of mushrooms ! (laughter). That is the trouble. If there is no means of reducing taxation, is there any means of reducing the price of mushrooms to make them more easily available to a greater number of people ?"

Lady Leese warmly thanked M. Simon for his excellent and witty speech " as a housewife and as the wife of a grower—rather different roles." When she shopped as a housewife and found the prices of grape-fruit or peaches too high she got very cross, and yet she got even angrier when, as the wife of a grower, she read about the Housewives' Guild complaining of the price of cabbage or tomatoes when it had been a particularly hard year to grow them ! Incidentally, she had never heard of their getting up a subscription for the poor growers when there was a glut.

"Of course, it would be perfectly simple for the housewife and the grower's wife to get together and round on the wholesaler and retailer," said Lady Leese. " I might agree to this method if I did not remember the winter of 1946, when we used to bring our produce into the market at dawn. I can see that cold bleak market now, on those early mornings, and remember the inevitable smile and cheery word of the salesmen. Neither as a housewife nor as a grower could one do anything but admire the courage and cheerfulness of these market people, or envy them their percentages or dues. As for the retailer I know less, and there are no doubt crooks in every community ! (laughter). But those I do know work very hard and many of them have to face a great percentage of losses when the weather is difficult or the housewife wants too little. **I think the only way is for the housewife to learn something of the difficulties and worries of a grower** (applause). She is, after all, one of the most sensible people we have in England to-day and one of the most hard-worked ; but she does not, for instance, have the remotest idea of what growing mushrooms costs, or the risks of it. Nor has she ever listened to Mr. Middlebrook and Mr. Atkins arguing on the various merits of casing soils, temperature or peak heat, till the early hours of the morning, as we have done on many occasions at Worfield " (laughter).

Lady Leese suggested that the M.G.A.'s Publicity Committee should explain to the public the real difficulties and risks in mushroom growing. Remarks like " a mushroom grows in a night " and " it grows just like a mushroom " are likely to jeopardise the whole industry. If the Committee got to work there would be a lot more sympathy from the housewife.

"As a housewife I want to know what food value or medicinal value the mushroom has," she continued. " The housewife likes mushrooms. She wants them, and the growing children want them even more, because more and more young people will be going abroad, especially

to France, where mushrooms are a necessity to good cooking. Before the war we did not think much about vitamins, rather like the peasants who used to eat fungi in large quantities, unconscious that they were good for them. But lately the Americans, who are always good at this sort of thing, have discovered that cultivated mushrooms are a rich source of the B vitamins (riboflavin, nicotinic acid, pantothenic acid, etc.). They are very valuable, and so is folic acid, which is also found in mushrooms and is used to cure or prevent certain types of anaemia. You would probably not treat patients with mushrooms for deficiency diseases ; you would give them vitamins in a concentrated form. But the aim of the nutritionist is to give a good mixed diet as a protective measure, and **mushrooms possessing these vitamins can now be classed as a protective food.**

"That is what the housewife wants to know—that it is worth her while to spend a bit of money on something that not only gives pleasure and variety to her family but is also actually good for them. I think all harassed housewives would buy mushrooms if they had only read what Mr. Chapman Pincher wrote in the *Daily Express* on 28th March this year : *' A chemical called glutamic acid often improves intelligence in mentally retarded children and may boost the thinking powers in normal folk. The richest sources are mushrooms and peas.'* "

Mr. Hovell formally thanked Lady Leese for her brilliant speech.

FIFTH ANNUAL MEETING

To-day's Problem : Greater Efficiency to Lower Production Costs

HEAVY PROGRAMME FOR 1951

THE FIFTH ANNUAL MEETING OF THE MUSHROOM GROWERS' ASSOCIATION followed the Mushroom Lunch at the Connaught Rooms, London, on Wednesday, 4th October, 1950.

Mr. A. DeB. Hovell, Chairman, who presided at the outset, reported that during the past year the mushroom grower, in common with all branches of Horticulture, had had a very difficult time. " It is no comfort to tell you," he said, " but as a vegetable grower I can assure you that vegetable growers have had a far worse time than mushroom

BIGGEST SUPPLIERS IN ENGLAND

MANURE for the MUSHROOM GROWER

ROAD OR RAIL TO ANY DISTRICT IN ENGLAND

A good crop of Mushrooms grown by a Sussex customer on Stable Manure supplied by us.

We also supply Cow and Pig Manure for the Market Gardener.

★

D. C. BUSHELL & Co. Ltd.

AGRICULTURAL MERCHANTS

SANDHURST MILLS, CAMBERLEY, SURREY

Telephone : YATELEY 2241 (4 lines)

growers. But in spite of all difficulties we have to have faith in our industry and carry on. We notice that bad years are often succeeded by good years, and we shall continue to do our best. But I feel we must lower our costs ; many of us are trying to do that."

Membership Passes 500 Mark

Mr. Angus Watson, Secretary and Treasurer, presented his reports. " The year 1950," he said, " has been an extremely difficult one for the Mushroom Industry, costs continuing to rise and prices to fall. **Despite these facts, there has been a nett gain of 30 grower-members and 59 honorary members, bringing the total membership to 518.**

" Mr. F. L. Filmer had sat on the Glasshouse Produce Committee at N.F.U. Headquarters, with Mr. C. L. Sinfield as his deputy ; Mr. H. G. Boxall represented the M.G.A. on the Ministry's Grading and Marketing Sub-Committee ; and Sir Oliver Leese was our representative on the Council of the N.F.U. Market Produce Show Society. The attendances of the Committee members during the year were as follows : Mr. Hovell (Chairman) 4, Mr. Atkins (Vice-Chairman) 4, Mr. Patterson (N. Ireland) Nil, Mr. Allsop (Scotland) 3, Mr. Chamberlain 2, Mr. Middlebrook 2, Mr. Filmer 4, Mr. Stewart-Wood 4, Mr. Harding 4, Mr. Sinfield 4, Mr. McArthur (Scotland) 1, and Captain Lawrence 2.

" The Editorial Board has tried to maintain the standard of the Bulletin, with what success is best left to members to judge. The circulation is still increasing and where necessary the size of the Bulletin is varied to suit our needs ; the July Bulletin was an exceptionally large issue. The Board welcomes any suggestions which will tend to improve either the News Sheet or the Bulletin. Last year the Bulletin had shown a profit of £86—this year there was a loss shown of £84, which should be reflected in the quality of the organ.

" The remaining item is a report on the Research Open Day, held on the 4th May, 1950. There does not appear to be any doubt about the success of the venture despite the unkind weather. Visitors and members had been kind enough to pass many compliments upon the part played by the M.G.A. in the show and many useful pointers had been noted for future improvement. Many letters had mentioned the excellent spirit which had prevailed and the cordial relations existing between the sundriesmen and the growers. The M.G.A. for its part had simply tried to improve the occasion for both the members and the Trade Exhibitors. A profit of £62 had been handed over by the M.G.A. to the Research Fund."

The Statement of Accounts, continued Mr. Watson, covered a period of only 10 months, as the end of the M.G.A.'s fiscal year had been advanced from 31st October to 31st August, to enable the Annual Meeting and Lunch to escape the autumn fogs which had jeopardised the success of past years' events. The main items of expenditure had been, as usual, salaries, printing, the contribution to the N.F.U. (which now stood at £171 p.a.) and an increase in travelling expenses. The balance of income over expenditure amounted to £41. (See page 60).

The Committee had decided to build an administrative office and had already obtained permission from the M.R.A. Board to do this on their land at Yaxley. This should constitute the last item of expenditure made in this direction, as all the major equipment needed had now been purchased.

Mr. Hovell expressed thanks on the Association's behalf for the very admirable way Mr. Watson had looked after their affairs (Hear, hear). " To have a Secretary who really has our interests at heart is something beyond price," he said, " and we thank him most sincerely for all he has done." (Applause). He felt he could not let the occasion pass without putting on record the Association's warm appreciation to Noble Mushrooms Ltd. for providing office accommodation free of charge for the past five years. (Hear, hear).

The two reports were adopted on the motions of Mr. A. G. Pointing and Mr. G. W. Baker, and of Mr. H. G. Boxall and Mr. R. Duthy, respectively.

Mr. Hovell at this stage vacated the chair. In doing so he explained that during the past four years the M.G.A. had had a fresh Chairman each year and he wished to take advantage of that precedent, as he had a business to run and other commitments. " I may if I wish stand for a second year," he said, " but, as I prefer not to, the chairmanship passes automatically to the Vice-Chairman. We have a very excellent new Chairman in Mr. Atkins, who is a founder-member of the Association and one of the best-known mushroom growers in this country. I cannot think of anyone more suited to be chairman of the M.G.A." Mr. Hovell expressed his personal appreciation of the support given him during his year in office by the Executive Committee.

Mr. Fred. C. Atkins, in taking the chair, congratulated Mr. Hovell on his very successful year. The Executive had particular reasons for being grateful to Mr. Hovell's wide experience in matters horticultural, for his refusal to be brow-beaten by those in authority, and for his happy blending of two interests which might appear to be conflicting—the M.G.A. and the Worthing and West Sussex Growers, both of which he had led. It must have given him great satisfaction to look back 10 years, when he had been a very lone voice protesting against the penal restrictions then imposed on the growing of mushrooms under glass.

Election Results

The result of the ballot was announced as follows :—

Chairman : Mr. Fred. C. Atkins (Northants).
Vice-Chairman : Mr. John Stewart-Wood (Bucks.).
Secretary/Treasurer : Mr. Angus Watson.
Auditors : Messrs. Stephenson, Smart & Co.

Executive Committee: Messrs. A. DeB. Hovell (Sussex), H. G. Boxall (Sussex) and J. E. R. Simons (Essex).

M.G.A. Directors on M.R.A. Board:

Messrs. A. DeB. Hovell (Sussex), F. C. Atkins (Northants), J. Stewart-Wood (Bucks.), A. G. Pointing (Wilts.) and McG. Bulloch (Dorset).

The Mushroom Industry To-day

Mr. Atkins recalled the major developments which had taken place under his distinguished predecessors, and posed the query : now that it was his turn, what did he find ? His reply was forthright. " I find a half-heated return to the wrong-minded attitude of Everyone For Himself, cuts in long-term projects, M.G.A. membership only just holding its own, mushroom farms up for sale all over the country, mushroom research in the balance. I see again the bayonets of suspicion and jealousy which for so long preserved us from progress and efficiency. I see the axe of false economy discouraging a renewal of M.G.A. membership (as if four untaxed guineas could not be afforded). I see the sword of Damocles precariously poised above the M.R.A. (as if one untaxed guinea per 1,000 square feet were a high premium to insure the future).

" Bayonets, the axe and the sword—all because for a period in June we were returned a shilling a pound for our marvellous produce ! But let us place this grim picture in its proper setting. A great many growers of other crops have been unable to sell their vegetables at all. We are still able to dispose of all we produce, and surely we can snatch a crumb of consolation from the fact that lower prices bring mushrooms within the reach of wider and wider fields of consumer. I think we should regard the taste for mushrooms acquired during that cheap period as subtle propaganda for the future. It is a fact that more people are eating cultivated mushrooms than ever before, in preference to those repulsive wild things gathered in the fields by heaven-knows-whom and contaminated by Lord-knows-what ! A major endeavour will be made in the next 12 months to encourage healthier habits among mycophagists." (Laughter).

Mr. Atkins said he thought the problem for 1951 was *how to change our procedure to make half-a-crown a pound a worthwhile return.* There were growers, of course, who said they could keep going even though

prices fell below a shilling a pound, but he had more than a suspicion that these people felt that, having made their bed, they must lie about it! The rest of us were desperately anxious to increase our efficiency before prices fell further.

"It is one of my jobs to study the means whereby the efficiency of a mushroom farm may be increased," Mr. Atkins went on. "No single measure has been more fruitful in my experience than a frank, open talk with other growers, and the formation of the M.G.A. on that ground alone has been more than justified, for it enables us to meet many growers who otherwise would be unknown to us. **I therefore propose in 1951, with your co-operation, to hold a series of informal meetings in different parts of the country.** (Hear, hear). Area Meetings have long been "on the books," as it were, but for several reasons (particularly the rationing of petrol) they had not matured. But in 1951, over lunch or dinner, a glass of beer, or on a farm—it doesn't really matter where I suggest we get together in various parts of the country and talk things over. Informality will be the keynote of these Area Meetings, and no one need come who is not prepared to put his cards on the table.

Refresher Course Planned

"Secondly, if you will excuse the apparent implication, I plan a Refresher Course for Mushroom Growers. I attended such a course devised for N.A.A.S. advisers recently, and was astonished and humbled to learn so much. *At this Refresher Course it will be possible to learn of the highest developments from the leading authorities in their respective spheres*—Dr. Edwards, Mr. Glasscock and Mr. Moreton have already consented to give illustrated talks. With any luck the Ministry's new film strip on Mushroom Growing will be available by then.

"The third matter I must mention is, of course, Research. It is true that the more we know about mushroom growing, the more we realise how much there is still to know. It is equally true that the less we know, the more we think we know—which, in my view, is why we have such a struggle each year to get funds for the Research Station." (Laughter).

He was often told that "research is so expensive." Did those who said that realise that without past research there would be no Mushroom Industry as they knew it to-day? They need go back only to pure-culture spawn to realise the strength of that argument. If it be true that last year's turnover in the Mushroom Industry was in the region of £5,000,000, was mushroom research expensive when it cost the grower less than 0·05% of that sum, or one-eighth of a penny for every £ coming in? He agreed most heartily with Sir Oliver Leese when he said it was **"utter madness on the part of the industry not to subscribe whole heartedly for a proper research station such as almost every other branch of horticulture possessed."**

"The response to our Research Appeal in 1950 had not been as good as in the previous year, which was not unexpected," said Mr. Atkins. "That was why I asked you all in August to let me know what you might be sending along in 1951. It seemed stupid to go on getting further into debt, and we wanted to know what sort of coat we could cut from the available cloth.

Increased Grant for Research

The usual one-in-three went to the trouble of replying, and we had hopes of £1,200. But we need £2,500 under the present 50 : 50 arrangement with the Ministry. So, with heavy hearts, a deputation went along to the Ministry of Agriculture where, as usual, we were most courteously received. Our tale of woe was heard in sympathy, and this morning I learnt from the Ministry that,

> **provided the Mushroom Industry finds AT LEAST 25% of the net maintenance costs during the next three years, the Ministry will make up the remainder."** (Applause).

Acceptance of this most generous offer meant that the Industry would have to find about £1,500 a year instead of £2,500. It meant also that mushroom research would continue on its present scale for at least another three years and that *by then there was every chance that the proposed national glasshouse research station would be in existence and ready to relieve the Industry of all further financial responsibility for mushroom research.*

Opening the discussion on policy for 1951, Mr. Atkins reported that, apart from the Refresher Course and Area Meetings already referred to, a Research Open Day at Yaxley was already being planned for Thursday, 3rd May, together with another Trade Show ; a stand at the Ideal Home Exhibition was under consideration ; it was hoped that an attractive book of mushroom recipes would be prepared by the Wine and Food Society with the co-operation of the M.G.A. ; and the next Annual Meeting and Lunch would probably be in London on Wednesday, 3rd October, 1951. " What else shall we do—or shall we not do all these things ?" he asked.

Middlebrook is Hurt !

Mr. Stanley Middlebrook : We are all a little hurt at it being suggested that we need a refresher course ! (Laughter). We are all of the opinion that we can grow mushrooms better than anyone else—until we go on to the other fellow's place ! We would like some more information about what precisely this means.

Chairman : The purpose of this course is to bring our minds up-to-date. During the recent period of low prices the mushroom grower has withdrawn into his shell and the average grower is not quite *au fait* with the latest developments. I think it would be to the benefit of all of us if we were to hear at first hand from those who are specialising in our different problems, hear what they are doing to-day, their conclusions from yesterday and their work for the morrow. It is, of course, up to you. If you say you do not want it, it need not be held. But if we do have one, and you come along, I think you will find it worthwhile.

Mr. Hovell : I think from your opening remarks, Mr. Atkins, you will more than justify your place as Chairman. You have sketched out a most admirable programme for the coming year, and it is a great thing for an Association to know what it is going to do. I recall the great advances which most growers have made in the last few years, and that many who hid themselves behind locked doors are the first to seize on the new ideas brought forward. I think they themselves would benefit very much if, when they made little improvements, they in their turn put them forward so that all might benefit. We have to produce mushrooms cheaply enough for everyone to be able to buy them. It is no good producing a few at such a high price that they can only be luxuries for the rich. I think that if we can only work together we can very much reduce the cost of production.

Chairman : I would like to get an opinion as to whether a Refresher Course is desired.

Mr. R. Dumbreck and **Lt. Col. E. Noel** urged that it was, supported by cries of " Yes," and on their resolution it was agreed.

Advice Worth Paying For !

Lt. Col. Noel : If, three years ago, when I started growing, I could have got really valuable advice I would gladly have paid substantially for it. I would have been a richer man than I am to-day. Many people who take up mushroom growing have no knowledge of the crop but rush wildly in as I did. If the M.G.A. could put up a scheme whereby in return for a substantial fee, say 40 or 50 guineas, they would give a considered report on any proposition, on a farm a man wanted to buy, or on a new farm he wanted to start, it would be well worth his while putting down that money. He would have to put his ideas down on paper, to clarify what he wanted to do, before he received a visit and a considered report from the M.G.A.

Mr. Middlebrook supported : We are here to help newcomers, but they must be genuine newcomers. And one cannot afford in these days to be away for long on such errands, and I think we would be quite justified in making some charge for our advice. But I think they should be genuine growers.

Mr. W. R. Wallace : What is meant by a genuine grower? (Laughter). I speak as a potential grower.

Mr. Middlebrook : Not a man who comes along, spends the whole afternoon with you and at the end of it tells you he has bought a sack of manure and proposes to go in for mushrooms in a big way ! I think it is possible to tell from a man's attitude whether he is serious or not.

Mr. Duthy : A young man arrived at my farm and explained to me his plan to put down 500 square feet every time his wife had a baby — to help pay for the squatter ! I explained to him that one could not run a farm profitably under 20,000 square feet, so he had better hurry up ! (Laughter).

Mushroom Adviser Wanted

General Sir Oliver Leese : I want to bring up the point of view of growers who are some distance away from the areas where there are a lot of growers. During the last year we have come up against what to us is a serious porblem. We have now got somewhere between 14,000 and 16,000 square feet and for the last nine months we have had a disease to which no one knows the answer here or in America. It reduces our crop 50%. We are right away from anyone, but we would like someone to go to. We cannot get anything from any research station which gives us any help ; that is why I say it is madness not to go full out for research. Many of those big growers in Sussex should come in and help in building up the research side of the Mushroom Industry. Unless they do we shall always be in this difficulty.

The Government has been very gracious and courteous in agreeing to pay 75% of the cost of our research. *I propose that we ask them to help us a great deal more, both on the advisory side and in immediate advice on research !* At the moment, in my part of the world, if you ask any advisory person to come over and help you, they will come over but they know absolutely nothing at all about mushrooms. I feel we should go to the Government and ask them to help us on the advisory side. They spend a lot of money now on the advisory services in the counties. **I suggest that there should be one person, the greatest expert they can find on mushroom growing, and he should be centred on Yaxley with Dr. Edwards.** If a grower like myself is in trouble, that man should come out and give us advice. He could go back to the Research Station, work on the problem and give us the help we so much want. I hope you will put this idea up to the Ministry and point out that all this talk about advisory services for mushroom growers does not really work at all.

Brigadier J. S. Nichols agreed with Sir Oliver. One adviser had come to him and said : *" It is my duty to advise mushroom growers, but I am afraid I do not know much about it."*

Mr. Middlebrook : When the N.A.A.S. first started we expected no help. I suppose I have been extremely fortunate, but in my part of the world we have one of those advisory people who is so frightfully interested that he is beginning to know more about mushrooms than many of us here. I would like to say that there are people in the N.A.A.S. who are willing to learn and that **it is up to us growers to help them to learn.**

Chairman : I am quite prepared to go and see Mr. C. E. Hudson, head of the horticultural side of the N.A.A.S. But who would this man be and how long would he take to train to the stage where he would be of real use to the established grower ? What has Mr. Glasscock to say on this point ?

Mr. H. H. Glasscock, N.A.A.S. advisory plant pathologist and authority on mushroom diseases : I cannot pretend to give an official reply. I can only say that the N.A.A.S. since its inception has been very much a " thin red line " and the number of horticultural advisers available for all commitments is so small that they rather tend to race round at high speed and, in their ordinary training, mushrooms rarely come into the curriculum. Mushroom growing is so specialised that any officer would really have to get down to it and do a little practical work for six or twelve months before he began to know what he was doing. Even then, is the information available in the case Sir Oliver mentioned ? He has a disease about which nothing is known here or in America. It would be awfully difficult for an advisory officer to give advice without data on that disease. The solution here seems to lie in research rather than in advice.

Sir Oliver Leese : I would like definitely to say, talking rather frankly as I am, that I hope Mr. Glasscock and everyone realises that I am great friends with the N.A.A.S. round us, and could not be more grateful to them. What I do say is quite definite, and it is this : A man may not be able to say " You can do this or that with the disease," but if he can say " You should take these measures for cleanliness," it would be most helpful. With tomatoes and cucumbers almost everyone can tell me what their diseases are ; but not one at the moment can help me over mushrooms. *That is why I say to the N.A.A.S. that instead of messing about when you know you can do nothing, concentrate on one man to advise us on mushroom problems !*

Mr. Duthy : I would like to support Sir Oliver, but I cannot see why with our existing machinery it cannot be done now. I suggested years ago that a charge should be made for people who want help on their farms, and I see no reason why a charge should not be made for the expert advice already available through the M.G.A. and the M.R.A.

Dr. R. L. Edwards : I think it is generally accepted that advice depends originally on research. Some comes from growers' general experience which, with research, is built into the general picture. There are three quite definite stages in this process :

1. To carry out research work, either experimental or the observation of growing.
2. To get that information over to the grower—this is quite a definite stage.
3. To persuade the grower to use that information.

You have all recently had a questionnaire about the proposed research programme for 1951. The answers are now coming in, and some of the things we are asked to study are quite staggering. The most obvious example is that quite a lot of growers want us to carry out research on the prevention of infestation by phorid and sciarid flies. I have been of the opinion for the last two years that no grower using shelves or trays on concrete floors has any business to have these flies. Under these conditions they can be completely controlled by using BHC.

Up to yesterday, in 25 replies received to the Questionnaire, 14 *included items marked for research which we could answer immediately from past research or experience, or both.* That shows the gap between existing knowledge and its application by the grower. It does not matter whether existing information is passed to the grower by the specialist advisers, by the Chairman's proposed refresher course, or by area meetings. All such means will help.

Concerning a charge being made for advice, there has always been the fear in our minds that such a charge would be paid instead of the ordinary research subscription. That would defeat our main object, which is to do research. It would certainly help everyone if we could have one specialist officer in the N.A.A.S. to deal with mushrooms. We would be very pleased to have him at Yaxley or visiting us as often as he could. It would help us enormously to get a better picture of growers problems. If you could get hold of someone who is a bit familiar with general mushroom growing I think he would pay his way almost from the start.

Chairman : Most of us appear to be agreed that at the present rate of progress we can expect little substantial help from the N.A.A.S. I think that was rather expected. We have tried to help individual officers as much as possible, but it is only those specialist officers who have taken particular interest in our problems who are able to help us—Mr. Glasscock, Mr. Moreton and one or two others. I think Sir Oliver's suggestion is a very fruitful line to follow. Our biggest problem would be to find the right man.

It was unanimously agreed to approach the N.A.A.S. with the request for the appointment of a specialist mushroom adviser.

Competitive Quotations

Mr. Duthy : I feel that a great deal could be done by the M.G.A. in advising members where they can buy the best stuff cheaply. I suggest that the M.G.A. not only quote the names of firms as they appear in the book written by Mr. Atkins, but also get competitive prices for all the things that growers want.

Chairman : I feel it is incumbent on an individual grower to get quotations for any material he uses in quantity and to check up one against the other. Whether it would be advisable for the M.G.A. to ask for competitive quotations all round is debatable. But if one firm

felt that its quotations were to be published and that low quotations might result in a considerable increase in business, the Editorial Board would consider Mr. Duthy's suggestion.

Area Meetings at last !

Mr. G. W. Baker : May we discuss the Area Meetings for a moment ?

Mr. J. Stewart-Wood : The best idea ever brought up ! We all have a fund of information to exchange if only we can get together, but I know there are many in far-flung areas who cannot get together. But if we can hold the Area Meetings as conveniently as possible and publish the information in the Bulletin so that others may get the benefit of it, I think it would be a very good idea.

Chairman : What form would you like the Area Meetings to take ? Shall we go to a farm, have a lunch or dinner with set speakers, follow the Brains Trust idea, or have simply an At Home at some central hostelry where we can talk in small groups ?

Mr. Baker : I suggest that small sub-committees be formed in each district which can arrange meetings at farms.

Mr. W. A. B. Harding : I propose that each member of the Executive be Chairman of the local sub-committee, if possible.

Chairman : We do not want to put more deterrents in the path of those who might otherwise serve on the Executive !

Mr. A. G. Pointing : Ask for volunteers, and see how they space out.

Mr. Hovell : I am mindful of the Mushroom Conference at Birmingham, Mr. Chairman, at which you spoke and which was so well attened. I wonder whether the N.A.A.S., who organised that Conference, would help with these Area Meetings ?

Mr. Glasscock : I am sure that would be an excellent idea, because the N.A.A.S. is so very much accustomed to that sort of work.

Chairman : Excellent ! We have eight provinces.

Mr. Glasscock : Twelve, with the sub-provinces.

Chairman : Twelve is rather a lot !

Mr. Baker : While I have a great respect for the N.A.A.S., would it not rather involve things ? We would find 80% of the attendance were horticulturists, not mushroom growers.

Mr. Glasscock : There would be no difficulty about that if you made your wants known.

Mr. Middlebrook : It is a very good idea to make use of the N.A.A.S. as they would finance the meetings, and that is important !

Mr. Stewart-Wood : I do not want to appear narrow-minded, but I think if we have these meetings they should be restricted to members only. If anyone wants to come and get information he should become a member first (Hear, hear).

Chairman : Shall we think this over ? Will those of you who feel strongly either way let Mr. Watson know as soon as possible ?

Publicity for Mushrooms

Mr. R. Patterson : What has the sub-committee done with publicity for mushrooms this year ?

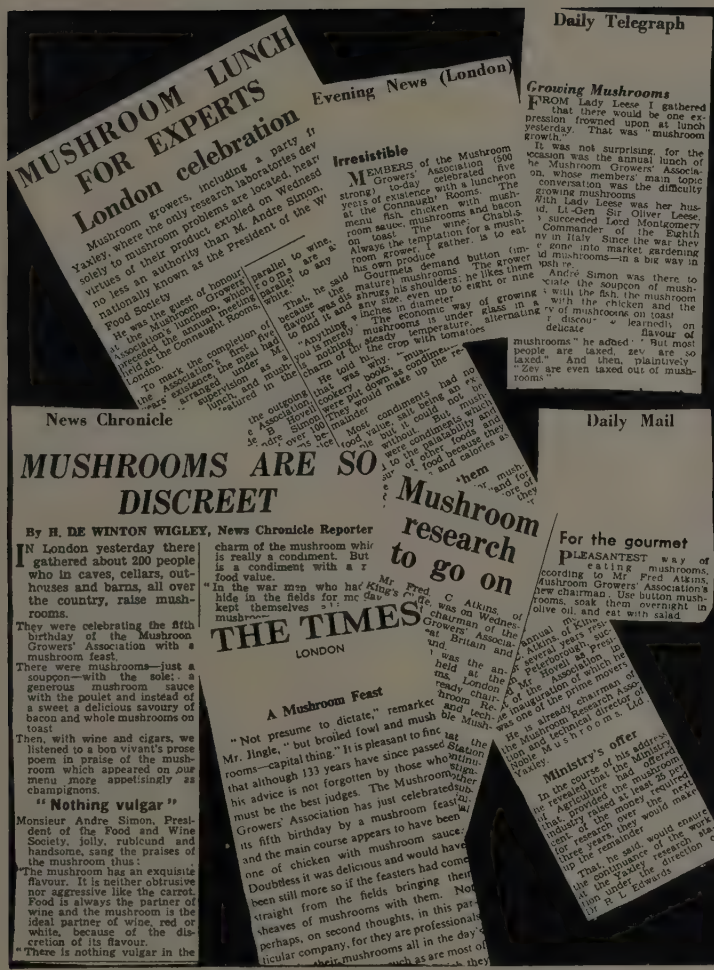
Chairman : As that committee's former Chairman I can say : Remarkably little ! It has been essentially a mental exercise which is summarised in October Bulletin 21. The suggestions are tentative. One tangible development has been the Mushroom Lunch with a world-renowned gourmet as Guest of Honour. I think you will agree that M. Simon's and Lady Leese's speeches were absolutely first-rate propaganda. Half the daily papers and all the Trade Press were represented here, and I am sure the Mushroom as Food will be " splashed " throughout the country during the next few days as never before.

Photograph by courtesy Sport & General and British Farmer.

A group taken just before the Lunch. *Left to right :* STANLEY MIDDLEBROOK (Chairman, 1948), FRED. ATKINS (Chairman, 1951), SIR OLIVER LEESE (Chairman, 1949), ARTHUR HOVELL (Chairman, 1950), LADY LEESE and ANGUS WATSON (Secretary). In the background may be seen MR. W. C. MOORE and DR. R. L. EDWARDS.

5928 A

5928 B



MUSHROOMS MAKE THE HEADLINES

A selection of press cuttings which followed the Mushroom Lunch.

Facing are two views of the tables taken by RAWOOD LTD., of London. Copies can be obtained from the Secretary for 11/- each (unmounted) or 14/6 (mounted), this price including postage and packing.

THE MUSHROOM GROWERS' ASSOCIATION
STATEMENT OF ACCOUNTS for the period ended 31st AUGUST, 1950
INCOME AND EXPENDITURE ACCOUNT

1949	Dr.	£ s. d.	£ s. d.
£	£		
509	To Salaries and Clerical Assistance		500 17 11
168	,, Postages, Printing and Stationery		175 5 3
10	,, Advertisements		9 12 0
5	,, Subscriptions to Trade Journals		4 1 0
78	,, Travelling and Hotel Expenses		122 3 11
39	,, Telephone, Telegrams and Sundry Expenses		22 11 4
6	,, Bank Charges and Cheque Books		5 13 6
12	,, Audit Fee		12 12 0
—	,, Legal and Other Charges		9 13 6
—	,, Cost of Bulletin, etc. per Contra		84 0 1
		£ s. d.	
82	,, Cost of Luncheons, etc.	141 14 1	
62	,, *Less* Sale of Tickets	78 0 0	
20			63 14 1
—	,, Reserve for Doubtful Debts		30 2 3
27	,, Depreciation		25 8 10
			1,065 18 8
	,, Balance—being Excess of Income over Expenditure for the period		41 12 10
			£1,107 11 6

1949	Cr.	£ s. d.	£ s. d.	£ s. d.	1949
£					£
	By Subscriptions from Ordinary Members 1949/50		1,111 15 0		
1,171	*Less* Amount due to N.F.U.		171 2 6		
				940 12 6	1,045
	,, Subscriptions from Hon. Members 1949/50			166 19 0	140
	,, Sale of Advertising Space in Bulletin and Literature		658 9 6		458
	,, Stock of Saleable Literature 31/8/50		200 0 0		95
			858 9 6		747
	,, *Less* Stock 1/10/49	180 0 0			
	,, Cost of Bulletin	538 6 0			
	,, Other Publications	224 4 7			
			942 9 7		
	Per Contra		£84 0 1		
				£1,107 11 6	

BALANCE SHEET, 31st AUGUST, 1950

£	LIABILITIES	£ s. d.	£ s. d.	£
	Subscriptions paid in advance :			
54	Ordinary Members	122 17 0		
7	Honorary Members	19 19 0		
61			142 16 0	
66	Sundry Creditors		38 13 6	
131	National Farmers' Union		171 2 6	
	Income and Expenditure Account :			
125	Surplus brought forward 1st Nov., 1949	471 18 1		
	Add Surplus for the period as per Income and Expenditure Account	41 12 10		
			513 10 11	
			£866 2 11	

£	ASSETS	£ s. d.	£ s. d.	£
	Office Equipment as at 1st November, 1949	244 8 2		
	Additions during the year	9 19 8		
		254 7 10		
	Less Depreciation	25 8 10		
			228 19 0	
	Library as at 1st November, 1949		4 3 2	
180	Stock of Saleable Literature		200 0 0	200
215	Cash at Bank		359 11 7	359
5	Petty Cash in hand		9 16 3	9
100	Sundry Debtors—Net		63 12 11	63
			£866 2 11	

EELWORMS (Nematodes) AS PESTS OF MUSHROOMS [1]

by

CHARLES A. THOMAS [2] & GEORGE H. MITCHELL [3]

We print with pleasure the following letter from Mr. Walter W. Maule, Secretary of the Mushroom Growers' Co-operative Association of Pennsylvania :

" Delay in answering your request of 24th August was due to the fact that Dr. Thomas had to clear the matter of permission to reprint our nematode bulletin with Pennsylvania State College. He has now received permission from the College and we are glad to join in making it possible for you to have a reprint made for the information of your members. We feel that our Mr. G. H. Mitchell and Dr. Thomas have made one of the finest contributions to the mushroom industry that has so far been made available. You must understand that this bulletin, while comprehensive in nature, is by no means to be considered as final. Messrs. Mitchell and Thomas are constantly making further tests, as well as observations. In addition, we are counting upon Dr. G. Steiner and Mr. Cairns at Beltsville Experimental Station, U.S. Department of Agriculture, to add considerable knowledge to that already known. These gentlemen have also contributed information on identification of eelworm species and also studies of thermal death points."

During the past several years there have been a number of very poor crops of mushrooms in south eastern Pennsylvania and northern Delaware. Examination of these crops and careful analysis of the various factors which might be concerned in causing them, have shown a number of factors which might have been at least partly responsible, one or two of which were practically always present in most of these crops.

Through the co-operation of many growers, we have been able to examine and study about one thousand samples obtained from fields, stored casing soils, compost piles, and scrapings from bed boards in empty houses. These samplings have pointed to certain constant and definite facts in regard to eelworms, as follows :

1. That eelworms are found in practically all soils, more in some soils than in others.

2. That eelworms are the cause, directly or indirectly, of many poor crops of mushrooms, and in at least some instances, have been the most important cause of total crop failures.

3. That several kinds or species of eelworms are involved in these crop losses.

4. That certain measures have proved to be of definite value in preventing crop injury.

5. That certain measures have value in controlling eelworms.

6. That eelworms are commonly associated with certain mushroom diseases, can act as agents for spreading these diseases, and in some instances, can cause symptoms which are usually thought to be fungous or bacterial diseases of mushrooms.

We have already given much study to this eelworm problem and plan to expand our studies and experiments in the future. We wish to express our sincere thanks to the many mushroom growers, allied tradesmen, and to Drs. Steiner, Cairns and Lambert of the Bureau of Plant Industry, U.S. Department of Agriculture, and to Dr. J. W. Sinden of The Pennsylvania State College, for suggestions and information. To Mr. Walter Maule and the Mushroom Growers' Co-operative Association of Kennett Square, Pennsylvania, we are much indebted

1 Authorised by the Pennsylvania State College Agric. Expt. Station as Paper No. 1594.
2 Entomologist, Pa. State College Agric. Expt. Station, State College, Pa.
3 In charge of Spawn Department, Mushroom Growers' Co-operative Association, Kennett Square, Pa.

for laboratory space and other facilities, without which this study could not have been adequately conducted.

We shall certainly appreciate any suggestions or samples that any grower may have to present at any time. Only by complete co-operation with all growers, can we hope to solve this eelworm problem.

In the following paper we present a number of questions which have been asked by the growers when they have brought their samples to us for analysis, and the answers we have given based on our studies.

1. What is an eelworm ?

According to the scientists who specialize in such things, an eelworm is a Nematode or Roundworm, but is not closely related to either an eel or a toad, except that they are all animals. Eelworms or " nemas " as we shall call them, are long, thin, cylindrical, worm-like creatures, very small (the adults of those found in mushroom beds are mostly less than one millimeter or one-twenty-fifth of an inch long, hence scarcely visible to the unaided eye unless occurring in groups ; they are whitish or transparent, so that under the microscope, the whole interior of the body is visible as if made of glass ; they are not jointed or segmented ; they have no legs of any kind and can move only by swimming in moisture, in a wavy, eel-like manner, hence the name " eelworm."

Nemas breed either by laying eggs or by giving birth to living young. The eggs are oval in outline, practically transparent, and may hatch within a day after they are laid. Thus the nemas can increase at a tremendous rate if conditions are favourable.

The newly hatched young nema is very tiny, practically colourless and very active. It may take some days for the young nema to develop to the stage where it can breed. In order to grow, they shed their skin several times as does a snake or a springtail.

These nemas are very resistant to unfavourable conditions. The older, full grown nemas may be killed by low temperatures, but the eggs can withstand such temperatures and can hatch and start infestations again when the soil becomes warm. In the same way, nemas and their eggs can become dried up or dessicated for long periods of time, and will hatch or resume activity again when moisture becomes a part of their surroundings. This state of suspended animation is called " anabiosis." In this manner, nemas can survive very long drying out in casing soil or in the dry boards of the empty mushroom house, and again become active as soon as the soil again becomes damp or the moist manure is placed in the beds. All of this is important in understanding how and why nemas get started in a mushroom house.

2. Is There More Than One Kind of Eelworm ?

The nemas concerned in mushroom injury have been found to be of two general types ; the first, which is the stylet type, has in its mouth-parts a short, hard, tubular spear or stylet with which it can pierce the mushroom mycelium and suck the contents from the cells, causing them to collapse. This has the same effect as cutting the fine feeding roots of a green potted plant—the top dies because it can no longer get moisture and food from the soil. Thus, the mushroom's source of food is cut off and the mushroom dies, or no more are produced from

that mycelium. The continual sucking and breaking down of the mycelial cells by thousands of nemas, therefore, is undoubtedly a large factor in stopping the growth of the crop. It is also possible that when the nema's stylet pierces the cell wall, it may inject some enzyme or other toxin which continues to break down the cells or to put their protoplasm into a condition from which the nema can more readily absorb it.

The stylet form of nema is represented in the mushroom houses by the form **Ditylenchus,** of which Dr. Steiner of the U.S. Bureau of Plant Industry has described several new species from the material which we have sent to him. Stylet forms seem to come into the houses usually with the casing soil.

The second type of nema found in our studies is the **Rhabditis** form. This does not have the hard, pointed stylus in its head, but instead, has a cylindrical throat or gullet through which it passes bacteria and other foods into its interior. Although its mouth parts are not fitted for piercing the mycelium, it is possible that they are hard enough to bruise the tissue.

3. Where Do They Come From ?

Nemas are found throughout nature except, perhaps, in the extreme Arctic regions. Practically every soil sample which we have examined has contained them, sometimes only a few, sometimes in vast numbers. In the tropics they occur in the soil, in the plants and trees, and some kinds are even parasites in animals and human beings (the hookworm of the South is one of these) but in our mushroom area practically all of them live originally in the soil. They are most likely to thrive and be abundant in soil which stays moist and fairly warm for considerable periods of time, as in lowlands or pockets on hillsides where moisture may collect. These conditions afford the best environment for them in which to breed, feed and move about. Undisturbed sod is also a good place for them as they find moisture under the grass plants and may feed on the fine root hairs of certain plants.

On the other hand, soil that is well drained, well cultivated or frequently disturbed, is less favourable to them, for such soils dry out rapidly and become hot, and conditions become unfavourable for their breeding, feeding and travelling, all of which require some moisture.

Therefore, the source of the casing soil, as well as the type of soil, particularly its water-holding capacity as well as its organic content, may all be important.

We do not know that raw manure, that is, manure on the car fresh from the stables, contains the species of nemas which we have found causing damage to mushroom crops, but we do know that as soon as this manure is piled on the composting ground, nemas from that soil begin to move up into the composting manure. They avoid the interior of the pile, which is too hot for them, but go up into the cooler, wet outside layer of the pile and spread throughout this layer over the entire pile if enough time elapses before the pile is turned. Although many are undoubtedly killed at each turning of the pile, due to being thrown into parts of the pile which soon heat up enough to kill them, many also escape by being in wet manure which is thrown into a location which doesn't heat up again sufficiently to kill them.

In this manner vast numbers of nemas escape injury and eventually are carried into the house in the manure when it is placed in the beds.

Then comes the heating of this manure in the beds. This heating is due to chemical action induced by bacteria and other micro-organisms which occur in all organic manures. If the temperature in the manure goes high enough, for long enough time, the nemas in that manure will be killed or so injured that they cannot later cause injury. However, we do not yet know the exact temperatures necessary to kill these nemas; recent studies have shown that some kinds of nemas can withstand considerably higher temperatures than can others. Indications are that the eggs are more resistant to high temperatures than are the active stages.

When the grower inserts a thermometer into a bed and reads 140° F., that is the temperature at the bulb of that thermometer. However, only a few inches away, a lump of wet manure may actually have a temperature of 135° F. or even 130° F., at the same time. In other words, there is a great variation in temperature in different spots, even in the same bed or the same section and, although the top temperature may be hot enough to kill all nemas at that spot, they may survive the lower temperature in some nearby spot and, after the heat has dropped in the house, they may work back into the remainder of the bed. Spots in the lower beds, especially on the manure surface, and between the sideboards and the posts, may not go above 120° F. and nemas may live there to reinfest the adjacent beds later. This is especially true of the first couple of sections of the bottom beds, near the door.

We have carried on very careful temperature studies in mushroom houses, placing thermo-couple wires in twenty or more places in various beds when they were filled, and taking readings twice daily throughout the heating period until a few days after the manure had dropped to spawning temperature. If steam was used in the house, readings were made at half-hour intervals from just previous, to several hours after the steaming began and ended. In this way we have gathered together what is perhaps the most complete set of figures and information on the temperatures attained by manure in heating houses. These figures are available to any grower who may wish to examine them.

4. What Injury Do Nemas Cause to Mushrooms?

Nemas cause injury to mushrooms in several ways: 1. The grower may have a good "first break" of mushrooms; even the second break may be good, but by the third break, bare spots may appear on the casing soil where no mushrooms are produced, or if pinheads appear they may stop growing and die. Of course, other factors, such as insects, mites, and certain fungous diseases may cause the stoppage of growth and the dying of mushrooms, therefore it is important to examine these bare spots and dead mushrooms carefully before assuming that nemas are the only or principal cause of the injury. If however, washing out of samples of manure, soil or mushrooms from these areas reveals tremendous numbers of nemas with a minimum of, or entire lack of, the above insects, mites or diseases, it may be assumed that the nemas were at least an important factor in causing such symptoms.

When the manure under these bare spots is carefully examined, one of two things may be found. First, the mycelium has entirely disappeared from the manure which has become wet or slimy and has a medicine-like odour entirely different from the smell of mycelium. At least part of this odour is due to the vast numbers of bacteria which have accumulated in this manure, but here are also abundant nemas, usually mostly of the "**Ditylenchus** type." These nemas undoubtedly carry the bacteria throughout the manure, as has been demonstrated experimentally by placing these nemas on agar-slants. Without the aid of the nemas to carry them about, the bacteria spread very slowly. It is common knowledge, of course, that bacteria cause the small pits, called "Bacterial Pit Disease" which are frequently found in and under the surface "skin" of small growing mushrooms, and as the mushroom grows, the skin splits, exposing the pit which contains a slimy or mucilaginous liquid which is composed of bacteria, plus the waste products from the tissues of the mushroom.

While the "pit" is still completely covered with the skin, although it may be visible as a darker spot under the surface, it rarely if ever contains any life other than the bacteria. However, as soon as the skin breaks open, the pit may be invaded by nemas, mites, fly larvae, springtails or other insects. Some of these undoubtedly feed on the bacterial slime or "ooze" and in moving from one pit to another, may spread the bacteria over the mushroom surface, over the soil, and even into the manure.* Water splashing over this slime can also wash and spread the bacteria over the bed. While the nemas and other animals are frequently seen in these pits, they are not always associated with this disease. Sometimes, also, nemas may be found feeding in open brownish areas of tissue containing bacteria on the bottom of the stems or in the gills where they spread the bacteria until the gills break down into a slimy mass. The mycelium or roots at the base of the mushroom stem are also attacked, first as small dead spots, then the whole root goes to pieces. Of course, such a dead or injured root cannot send food or moisture to the mushroom above it.

The second type of injury is again the stopping of growth of the mushrooms and the development of bare spots on the beds. However, instead of the manure being wet, slimy and smelly as above, the mycelium may still appear normal, perhaps a trifle reddish, but it still has the characteristic "spawn odour." It appears as if it should continue to produce many mushrooms but they do not "pin up" or form in the soil. Examination of this manure and soil shows large numbers of nemas present, especially in the soil, frequently of the **Rhabditis** group. Bacteria may also be associated with these nemas but usually not in such large numbers as in the foul-smelling, wet, slimy manure described above.

It is probable that the nemas in the soil and top of the manure, as just described, came into the house with the soil, especially after treatment with formaldehyde or no treatment at all, while the entire destruction of the mycelium in the manure as described in the first

* "**Rhabditis lambdiensis**, a Nematode possibly acting as a Disease Agent in Mushroom Beds."—G. Steiner, Journal Agric. Research, Vol. 46, No. 5, pp. 427-435, Mar. 1, 1933.

instance, is probably due to nemas which were either in the boards before filling, or nemas which came in with the manure when the beds were filled, or nemas from both sources. Thus, they had good opportunity to build up in the beds even before they were "cased." By the time the mushrooms appeared on the beds, the nemas had destroyed much of the mycelium.

5. Why Do We Seem To Have More Nemas Now Than We Did Several Years Ago?

Among the various suggestions as to why we seem to have more nemas now, the following appear to have at least some value :

A. Before the advent of the use of DDT for mushroom flies a few years ago, we had many fly larvae in the beds, and when we found damp smelly spots in the manure we also found many of these larvae. We therefore blamed the disappearance of the mycelium on these larvae and they undoubtedly did much damage by tearing the spawn pieces, chopping up the mycelium and boring holes into the pinheads and larger mushrooms.

However, with the widespread use of DDT, Methoxychlor, and similar insecticides, flies and their larvae have largely disappeared or their numbers have been greatly reduced. Nevertheless, we still find the damp, slimy, odoriferous spots with the mycelium usually missing, and consequent stopping of mushroom growth. As previously described, under the question of the type of nema damage, these spots are usually very heavily infested with nemas and bacteria, and it is probable that they always have been so infested. When we didn't find fly larvae in these spots we examined the manure more closely and found the nemas.

B. The outside six-inch layer of a manure pile is wet and comparatively cool, containing large numbers of nemas and other animals, while the interior of the pile is too hot for them to survive. When manure was turned only by hand forks, the grower usually tried to get the cooler outside layer of manure turned into the centre of the pile. Since nemas are so small and delicate, most of those turned in with the outside manure never again reached the new cool layer which formed on the outside, and the inside of the pile heated up again very rapidly and the heat killed them.

Observation of the turning machines now used shows that of the manure thrown against the end of the pile by the machine, some goes into the interior of the pile while some rolls down the outside of the pile where it again becomes part of the outside layer and hence never gets hot enough to kill the nemas.

When the beds are filled, lumps of wet manure from the outside layer of the pile become scattered through the manure in the beds, and either may never reach a high enough temperature when the house goes up in heat, or may remain hot enough for too short a time. Nemas may thus survive in the lumps and later work out into the surrounding manure and infest the beds.

6. Are There Any Natural Controls or Natural Enemies of Nemas?

Yes, a number of species of nemas in the soil outdoors feed on other kinds and in some instances probably exert quite a control of them.

In addition, there is a group of fungi or *Arthrobotrys* Moulds which actually feed on nemas, which become entangled in the mould mycelium in the soil outdoors. This mould may be carried in the casing soil, along with the nemas, into the mushroom house. Very often after the bare spots appear on the bed, the mycelium has disappeared, and the manure under these spots has become damp, slimy and smelly, the soil on that spot may be slightly sunken and on its surface appears a very fine, short, whitish or light grey mould, which, viewed against the light from an open door, looks like a whitish plush.

This surface mould is not a mushroom disease, as it was once thought to be. Actually it is a feeder on the nemas in the bed. After it has destroyed a large proportion of the nemas in the manure, which it does by entangling them in its mycelium and sending into the nema its hyphae or rootlets which kill and drain the nemas, it then sends this fine mould up to the soil surface where it develops spores which can be spread about by splashing water, air currents, insects, and other factors. The mould never entirely gets rid of the nemas in a bed but probably cuts down their numbers considerably. As the nemas move along in the manure and soil, the mould continues to spread with them.

It is interesting to note that some of the worst examples of casing soil infestations of nemas have been in soil which was treated with formaldehyde. From these observations we have concluded that the formaldehyde treatment has actually favoured the nemas, for we know that formaldehyde will not kill the nemas, that it is quite a good fungicide and will kill the *Arthrobotrys* nema-killing mould, and that elimination of this mould has allowed the nemas to build up at a terrific rate.

When infested casing soil is steamed, both the nemas and the nema-killer mould are destroyed.

7. What Control Methods Have Been Tried for Nemas ?

A. Treatment of Casing Soil : Several materials have been used to treat casing soil with the hope that nemas in that soil would be killed. Results to date have been disappointing.

(a) **Formaldehyde.** Mushroom growers have been using solutions of this material for many years to control diseases carried in casing soils. Undoubtedly, if correctly done, it has had value in controlling " Bubbles " (Mycogone) and several other mushroom diseases. However, of more than two hundred formaldehyde-treated soil samples that we have examined, none showed the treatment as being of any real value against nemas. Therefore, we cannot recommend this material for controlling nemas.

(b) **Chloropicrin or " Tear Gas."** We have examined a large number of soil samples which had been treated with this potent gas, yet in practically every sample many nemas survived. While chloropicrin is not considered the best nema killer, it would probably do a fairly good job if closed up tight with the soil for several days. In most instances, lack of kill may be due to leakage of the gas and consequent drop in gas concentration before the nemas, especially the eggs, have been killed.

(c) Other soil fumigants as MC², D-D, Ethylene Dibromide, Methyl Bromide and others are now under experimental trial and it is too early to report results.

(d) **Heat,** as evolved from steam, has given by far the best kill of nematodes in all casing soils which we have examined of which there have been more than 250 samples to date. Heat will penetrate through soil particles if given enough time to do so. Fumigants can go only around the soil particles and through the spaces between these particles. Furthermore, if much moisture fills these spaces the gas may not penetrate further into the soil.

In only three instances out of the above 250 samples, have we found that some nemas were not affected by the heat of the steam. In two of these the nemas escaped the heat because they were inside lumps of soil into which the high temperature did not penetrate. The temperature may have been high enough to kill the contained nemas if it had reached them but it did not stay hot long enough to penetrate to the centre of the lump before it cooled again. Killing of nemas, as with other animal and plant life, is a matter of heating them long enough after reaching killing temperatures. Usually, the higher the temperature, the less time required to kill them ; the lower the temperature, the longer the time. The exact temperature-time relationship has not yet been worked out for each of the several kinds of nematodes which affect mushroom culture and since this relationship is apparently different for each kind, we do not yet know all the facts as to what temperatures kill the nemas, nor how long they must be exposed to these temperatures to be sure of kill. These studies are progressing and when we have finished them we hope to be able to tell the growers exactly what temperatures are necessary for kills. From observation we may say that soil should reach a temperature of at least 180° F. and should hold near this temperature for several hours. Some soils may be somewhat injured by holding high temperatures too long.

Reinfestation. Even though soil may have been completely freed of nemas, there is still danger of such soil becoming reinfested if it is dumped on the composting wharf or on the dirt floor of the shed. This is especially dangerous if the floor or wharf is damp, inasmuch as nemas can then work up into the damp soil above them and gradually move on through the pile of stored soil. It is definitely worthwhile to store treated soil on some surface which is known to be free of nemas. Where steamed soil has been stored on boards or on corrugated iron sheets, there was little reinfestation of the pile, provided water did not stand high enough under these platforms as to touch the soil above it.

Nemas have no legs and the only means of their getting back into the soil above is by swimming in moisture between the ground and the bottom of the pile, or by being carried to the pile in mud on the feet of the men working with the soil. Heavy rains may also wash soil containing eelworms from a higher level into the pile. Therefore, the grower should be certain that there is good drainage around the stored pile and that the workers do not carry infected dirt into it on their shoes. Concrete floors, washed and swept before piling, are better than dirt floors for storing soil.

Another important feature is the manner in which dirt is stored after steaming. If the hot soil is merely dumped on the floor, the centre soil of the pile may stay hot enough to kill the nemas, but the surface soil, and the thin edge of soil which spreads out onto the floor, may cool so fast that some nemas may not be killed there. To offset this rapid cooling, the pile should be covered with tarpaulin or building paper immediately after dumping ; also the edge of the pile should be against a board at least one foot high against which the soil will stay hot longer than it will if spread out on the floor.

7B. How can Nemas be prevented from getting started in the new compost after the beds are filled ?

We believe the best control is **prevention** and this can usually be accomplished by obtaining a uniform manure heat of at least 140° F. throughout the beds and holding that heat for at least a day. If such heat cannot be attained naturally, then it may be necessary to use steam after the " peak heat " has been reached and the temperature has begun to drop, in order to penetrate spots which would not get hot enough to kill the nemas. Otherwise, these nemas will later infest the surrounding manure. However, do not drive the temperature up to 150° F. as to do so may make favourable conditions for *Chaetomium* and other moulds. A temperature of 140° F. for a few days is probably as effective, and safer, than 150° F. for a somewhat shorter period of time.

7C. Steaming the Empty House.

In addition to steaming the casing soil and obtaining a good heat in the manure in the beds, it may also be necessary to steam the empty house before filling to destroy the nemas which have gone into a dormant or resting stage in the surfaces and crevices of the boards. We have found many nemas on both sides of bed boards in empty houses. We also found that steam was more effective against them if they could be made active by wetting the board surfaces a day or so before steaming than it was against nemas in dry boards. Adding formaldehyde to the steam did not appear to increase the kill of these nemas in the board surfaces. Moving boards from the lower beds to upper beds before steaming may also give a better kill in those boards.

7D. Experiments were tried on the use of sulphur burned both on the floor and in the sulphur burner outdoors. In this machine the sulphur burns completely and much more rapidly because of air forced through it by means of a fan. Therefore, the concentration of sulphur dioxide gas is more than twice as high as when the sulphur is burned on the floor or walk within the mushroom house. Dishes and samples of manure infested with nemas, mites and springtails, placed throughout the houses being fumigated with sulphur, showed good kill of the mites and springtails, but poor kill of the nemas. Therefore, it is not recommended as a control for nemas in the empty mushroom houses.

7E. Methyl Bromide gas, released from tanks on the upper walks in two empty houses, at the rate of three pounds per thousand cubic feet of air space, gave only fair kill of the nemas in bed board surfaces and in cultures. Fans were used in an attempt to keep the Methyl Bromide gas in the upper part of the house as it is several times

as heavy as air ; however, in spite of this the most of the nema kill obtained was in the lower part of the house.

Experiments are under way to determine the value of other fumigating materials for use in the empty houses and during the heating of the manure, but results on these materials will not be available until we complete our tests.

Precaution.

In steaming the house while it is in heat, care must be exercised to prevent the temperature from going too high, that is, up to 150° F. Otherwise a manure condition may be reached which is favourable to the growth of **Chaetomium** and other moulds. This can usually be prevented by using one or more fans in the upper part of the house to drive the hot air downward and thus to equalise the temperature throughout the house. Admitting air to ventilate the house at intervals, instead of keeping it closed up tight all through the heating, also apparently has some value in preventing these moulds taking hold on the manure.

Electricity.

Experiments with 110 and 220 volt currents sent through infested beds failed to kill nemas in the manure or soil.

CONCLUSION.

As a result of our extended study of the nema problem, we have reached the following conclusions :

1. That Nematodes or eelworms, mostly of the groups **Ditylenchus** and **Rhabditis,** cause much injury to mushroom culture (a) by destroying the mycelium in the manure and in the casing soil. This injury may be due either to direct attack by puncturing or bruising the cells of the mycelium and mushroom tissues or (b) by carrying in or on their bodies, bacteria or other disease-causing factors which aid in this destruction. It may be possible that the nemas, or the bacteria, give off some toxin which causes the injury. We have spread bacteria experimentally by means of nemas.

   It appears possible that nemas may also cause damage which is at present attributed to certain fungous and other disease organisms. For instance, in the areas around Kennett Square, Avondale, Oxford, and Temple, Pennsylvania and Hokessin, Delaware, as well as in Maryland, growers sometimes find dead corky or " mummy " type mushrooms on their beds. Apparently no fungous or bacterial organisms have been found causing this condition, yet we usually find large numbers of nemas in the soil and on the broken " roots " of these mushrooms, and the disease spreads along the bed in the same manner and at the same rate as do the nemas in the manure. At times this condition may become very serious, destroying entire breaks or even crops on the infested beds.

2. Nemas are found in practically all soil outdoors, more in some locations than in others but apparently most commonly in moist places where they can continue to feed, breed and spread. Undisturbed soil, as sod and low spots in fields, are more likely to be

infested ; soils which are kept cultivated, while not entirely free from nemas, are perhaps less likely to contain large numbers of them because the moisture film on the soil particles is not continuous, and considerable cavities occur in such soil causing drying conditions and preventing the nemas from swimming about as they do in the continuous moisture film in an undisturbed soil.

3. No treatment to date has given a complete control of nemas in casing soil, except heat obtained by steaming. Formaldehyde, instead of killing nemas in the soil, may make conditions more favourable by killing the *Arthrobotrys* mould which normally feeds on the nemas. Chloropicrin has given variable results against the nemas, generally poor. Ethylene Dibromide, D-D, Methyl Bromide and other soil fumigants are now being tried and results are not yet available.

4. Nemas are common inhabitants of the outside layer of manure compost piles, and enter the houses originally both in this manure and in the casing soil. Heat, either from the heating of the manure, or from steam, or both, seems to be the only means of controlling nemas once they are inside the house. If not killed at this time, they continue to breed and increase their injury, and after the crop is finished and the old compost is removed from the beds, many nemas may remain in a dormant or dry state on the surface of the bed boards and enter the manure again when the beds are refilled. Steaming of the empty houses after wetting the boards will kill many of these nemas.

SUMMARY

1. Several kinds of eelworms or nemas cause injury by destroying mycelium in the manure of the bed, thus stopping mushroom growth. They can carry bacteria which cause " Bacterial Pit " and other diseases, and are usually found on the roots of " mummy " mushrooms.

2. These nemas are found outdoors in nearly all soils, more frequently in those which are moist or are not cultivated. Dry, cultivated soil is less favourable to their feeding, breeding and spread.

3. Nemas enter the mushroom houses in the casing soil and in the manure compost. Once within the house, they can also carry over between crops in the surface of the bed boards. Most old houses have them in the boards. Steaming the empty house, after wetting the boards to activate the nemas, helps to control them there.

4. To date, steaming has given the only good control of nemas in casing soil. Chloropicrin (Tear Gas) has given only fair control. Formaldehyde has given no worthwhile control, and may actually favour nemas by destroying moulds which feed on them.

5. The newly-filled house should be made to heat **uniformly** to 140° F. for at least a day or more, assisted by fans to equalize the heat upstairs and down. Steaming the house for several hours after the temperature begins to drop will help to heat the air and the outside of the bed boards ; the temperature should not reach 150° F. or moulds may result. Ventilation at intervals during heating may help to prevent moulds.

Sterilizing Casing Soil with Formaldehyde

BY

Dr. E. B. LAMBERT

A number of inquiries have been received recently concerning the best way to sterilise casing soil with formaldehyde, and we asked the advice of Dr. Lambert, Life Honorary Member of the M.G.A. and Senior Mycologist at the U.S. Plant Industry Station, Beltsville, Maryland.

Formaldehyde is usually applied to the soil in the summer time so that there will be a few weeks in which the treated soil will remain at a temperature of 70° F. or above. It is generally believed that better sterilization is obtained at the higher temperatures and the formaldehyde gas has a better chance to defuse in the soil and later to leave the soil. This summer application is probably desirable but is not necessary with a loam or sandy type soil.

One of our successful growers has for several years treated his soil in mid-winter and cases while there is a strong odor of formaldehyde remaining in the soil. To drive out the formaldehyde he maintains a temperature of 70° to 75° F. in the mushroom house for several days after casing and at the same time provides plenty of ventilation. He is also careful not to water the beds until all traces of formaldehyde odor have left the house. When using formaldehyded soil in this way the first break of mushrooms may be delayed a few days to a week, but there seems to be no reduction in the yield of mushrooms taking the crop as a whole.

Our growers use top soil and most of them screen it into long ricks about 6 feet wide and 6 feet high. The formaldehyde is usually applied as the soil falls from the screen on to the rick. The ricks are then covered with paper to retain the formaldehyde fumes and to protect the soil piles from rain or excessive drying out.

The formaldehyde should be applied when the soil is moist—not too dry, not too wet. If the soil is too dry, harmful para-formaldehyde may be formed and if it is too wet the diffusion of the formaldehyde gas may be unduly limited and the gas may not leave the soil promptly enough.

The strength of the formaldehyde solution applied varies from one grower to another. Many successful growers make up the solution of one part formalin (40% formaldehyde solution) in three parts of water and apply this solution at the rate of one gallon to one cubic yard of soil.

I hope that this rather rambling discussion gives you the information you desire.

MUMMY DISEASE

Swiss Outbreak Described by Dr. Clement Fleury

Most mushroom growers know that the spawn in a mushroom bed often becomes exhausted at the end of the crop and forms mushrooms of very small size, sometimes deformed and rotting easily. In fact this is not always a simple and inevitable process of degeneration. In certain cases we have found a great resemblance between crops on the point of exhaustion and others affected by a disease described in the United States by Tucker and Routien. This disease, more common than is generally believed, need not disturb the grower. Recognised in time it is easy to deal with and one can restrict the losses to a minimum. It is always necessary to watch for the disease, that is why we are describing the different stages in this paper.

Symptoms

The first symptom seen is the stoppage of growth of the mushroom with malformation, the cap is tilted, often on a curved stalk, and the base of the stalk is an enlarged mass of mycelium, forming a kind of false root (*pseudorhizome*), the tissue is spongy, in the cream kind more or less filled with liquid but dry in the white variety, giving a mummified appearance to some of the mushrooms, from which comes the name Mummy Disease used by the American authors. When affected mushrooms are cut they often grate on the knife as though they contain sand and cavities are found inside, black or brown, and full of bacteria (white variety). The spawn may still be active enough to produce further flushes of mushrooms, but they will be small and diseased. Infection usually appears at the 3rd flush and later. It is common in old crops at the end of production. It appears on a limited surface where the appearance of abnormal mushrooms can be noted and then spreads in a circle at the rate of 8-12" a day. The whole bed is quickly invaded, but the disease seldom spreads from one bed to another. Research on the cause is very difficult. While the spread is rapid within a bed, it is not often observed at a distance. We have not found any difference between healthy and diseased soil or compost in respect of colour, moisture, texture, smell, pH or presence of insects. Is it due to micro-organism, bacterium or fungus? Our observations on this question agree with those of the American authors. We isolated various cultures of bacteria from the dark cavities in the mushrooms. Infection experiments with these bacteria have produced black spots, but never the disease. These spots are secondary and the bacteria seem to be saprophytes established after the disease. However, the infected mushrooms are not contageous, but the disease is certainly transmitted by a casing soil or the compost of an infected bed which can contaminate healthy beds in three or four weeks. Tucker and Routien stated that all the treatments tending to promote the vigour of the mycelium, also favour transmission of the disease. Similarly, physical factors such as temperature and drying, chemical ones (disinfectants) and mechanical (trenches or bed boards) which impair or prevent the growth of mycelium also delay spread of the disease. These authors suggest that a virus seems to be responsible for Mummy Disease, and its spread depends on the presence of living mycelium.

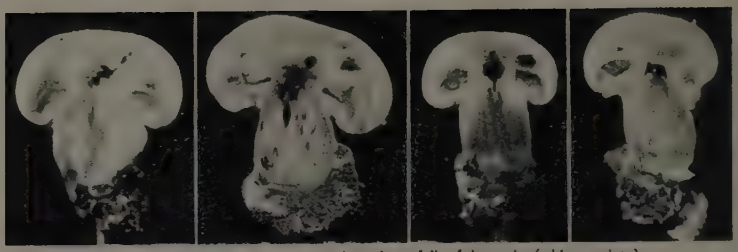


FIG. 1—Deformed mushrooms and pockets full of bacteria (white variety).

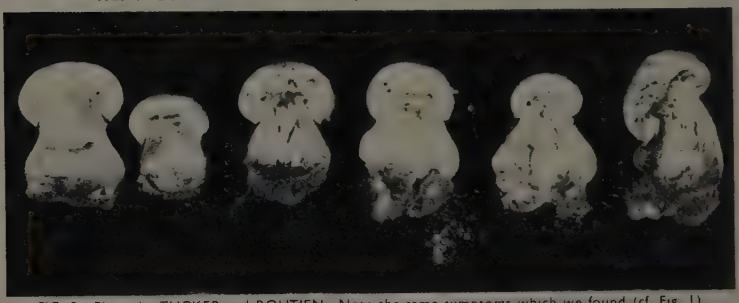


FIG. 2—Photo by TUCKER and ROUTIEN. Note the same symptoms which we found (cf. Fig. 1).

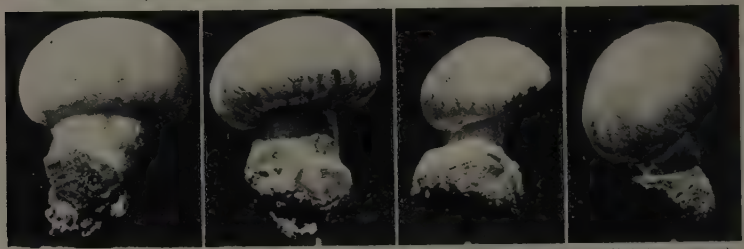


FIG. 3—Various deformities: Tilted cap, tapering stalk, mass of "false root strands" (white variety).

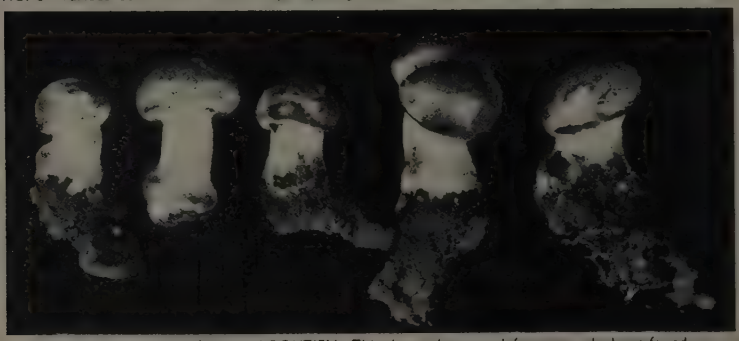


FIG. 4—Photo by TUCKER and ROUTIEN. This shows the same deformities which we found.

Treatment

Treatment is quite simple. It must be appreciated that in addition to the area obviously affected, there is a further infective area, still producing normal mushrooms, extending to 2 yards around the outside of the obviously diseased region. The treatment consists of (a) removing completely small beds which are infected, (b) cutting a trench 4" wide across large beds at least 2 yards on each side of the affected area, which can be lined with boards, cleaning and disinfecting regularly the space in this trench. The best and least toxic disinfectant is diluted sodium hypochlorite solution. Disinfection of the bed by spraying with strong disinfectant is not advised because it delays the growth of mushrooms.

Summary

We have just described for the first time in Switzerland, and possibly in Europe, a disease of the cultivated mushroom which we have identified as the Mummy Disease of Tucker and Routien. It appears particularly at the end of the crop and is characterised by a typical deformation of the mushrooms and the presence of secondary bacterial invasion. The infection spreads from the point of first establishment but depends on living mycelium. It may be due to virus (Tucker and Routien), a germ smaller than a microbe dependant on the existence of the living cells on which it is parasitic. The disease is easily treated if it is recognised in time. The treatment consists of isolating the infected areas of bed by trenching two yards beyond the infected area and disinfecting the trenches so formed.

Extract from Revue Horticole Suisse, 21, No. 10. October, 1948. pp. 279-282.

"GUNOS" BRAND

PULVERIZED

POULTRY GUANO

PURE NATURAL ORGANIC

REGULARLY USED BY PROMINENT MUSHROOM GROWING FIRMS AS AN ACTIVATOR FOR COMPOSTING

Samples and prices from the sole manufacturers :

THE HAMPSHIRE GUANO Co. Ltd.
SOBERTON
SOUTHAMPTON

AS EXHIBITED AT THE M.G.A. OPEN DAY, MAY, 1950

PINKERTON'S SCOTTISH MUSHROOM LABORATORIES

MILLERSTON, GLASGOW

'Phone : PROvanmill 4260
'Grams : " PROLIFIC," Glasgow

NEW STRAIN

Perfection in anything in life can only be attained by constant striving to reach that state, and although we consider that our Spawn, as sold to date, has no equal, we have never stopped trying to improve it. The efforts made along these lines have at last been rewarded, and by the time this comes before you, all Pinkerton's Spawn will be of an entirely new strain which has been fully tested and found to produce more lbs. per sq. ft. of better quality mushrooms than any other Spawn obtainable to-day. This new strain is of the white variety and is obtainable in Grain or Manure Type Spawn.

PINKERTON'S PROLIFIC
PURE CULTURE
Mushroom Spawn

Obviously a case for the Specialist!

WE ARE SPECIALISTS

IN THE DISTRIBUTION AND SELLING OF

MUSHROOMS

We have a Department with an experienced Sales Staff devoted to the selling of Mushrooms . . . . and nothing else.

Such SPECIALISATION and concentration on one type of produce MUST produce results which are the best obtainable.

We are at your service.

*

For full information write to :

FRANCIS NICHOLLS LTD

Smithfield Market

BIRMINGHAM

TELEPHONE: MIDLAND 6001 (7 LINES)
TELEGRAMS: NICHOLLS · SMITHFIELD · BIRMINGHAM

Sell to North East England through the House of Leatherland! We provide all Growers with an efficient and comprehensive marketing service, in one of the most closely populated areas in Great Britain. Our reputation and long-standing association with leading growers is your guarantee of our whole-hearted attention to your interests. We will be pleased to have your enquiries.

FRUIT, FLOWER
THE HOUSE OF LEATHERLAND
AND VEGETABLE SALESMEN

G. E. Leatherland
LIMITED

20 - 22, ST. ANDREW'S STREET,
NEWCASTLE-ON-TYNE, 1.

TELEPHONE: NEWCASTLE 28451 TELEGRAMS: "ORANGES,"

For THE CONTROL OF

MUSHROOM FLY

★ At Peak Heat use

CYANDIE

CYANIDE FUMIGANT
(MUSHROOM GRADE)
Use at 1 to 1½ lb. per 1,000 cubic feet
10 lb. tins - - - **35/-**

★ If the beds are cropping free, fumigate with

MURFUME
BHC or DDT

MURFUME BHC SMOKES
Cannister to fumigate 10,000 cubic feet
Boxes of 12 cannisters - **57/-**

MURFUME DDT SMOKES
Cannister to fumigate 5,000 cubic feet
Boxes of 6 cannisters - **30/-**

Cannister to fumigate 2,000 cubic feet
Boxes of 12 cannisters - **32/-**

Write to-day for our booklets
"Control of Pests and Diseases on Mushrooms"
"Murfume Smokes"

THE MURPHY CHEMICAL COMPANY LIMITED

WHEATHAMPSTEAD
— HERTS. —

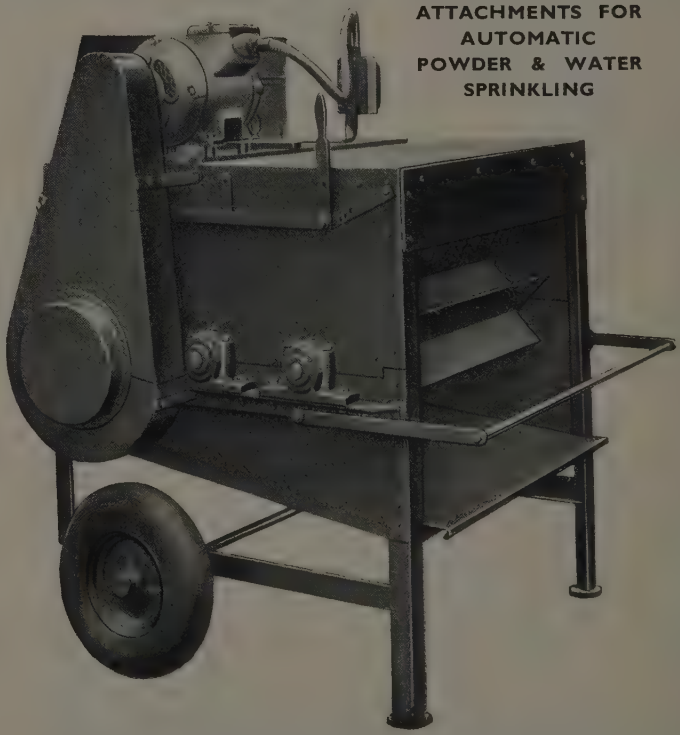
PERFECT MANURE TURNING

100% AERATION 100% TEASING

No. 6

DLP COMPOSTER

ATTACHMENTS FOR AUTOMATIC POWDER & WATER SPRINKLING



DESIGNED & MADE FOR NOBLE MUSHROOMS LTD., OF YAXLEY

INQUIRIES TO:

HARRY F. ATKINS (Machine Tools) Ltd.

OLD FLETTON, PETERBOROUGH

'Grams: "ATKINS, OLD FLETTON" Tel.: Peterborough 2852

MOUNT
MUSHROOM
SPAWN

USED BY
SUCCESSFUL
GROWERS
FOR 25 YEARS

MOUNT MUSHROOM SPAWN LABORATORIES
LITTLEBOURNE, CANTERBURY, KENT

SPECIALIST PRODUCTS FOR MUSHROOM GROWERS

TETRYL

Ready mixed H.E.T.P. spray, only requires dilution with water. Controls mites, springtails and fly in mushroom beds—does not leave any poisonous residue.

10% D.D.T. EMULSION

Made up with no oil or other harmful solvent. Quite safe to use on mushroom beds for the control of fly. Does not cause staining.

STERIFORM

Special form of non-polymerising formal dehyde specially suitable for mushroom casing soil. Controls verticillium, fusarium, dactylium, etc. Also ideal for washing down houses.

P.B.I. also supply special 5% or 10% White D.D.T. dusts, B.H.C. dusts and Nicotine Powders. Supplies are always available and we welcome your enquiries.

Sole Manufacturers

PAN BRITANNICA INDUSTRIES LTD.

WALTHAM ABBEY, ESSEX

J. COLLINGRIDGE LTD.

1890
TO
1950

60 YEARS

KNOWLEDGE OF SELLING MUSHROOMS IS AT YOUR DISPOSAL, AND YOU CAN CONSIGN TO US WITH CONFIDENCE.

OUR EXPERIENCED REPRESENTATIVES ARE ALWAYS AVAILABLE TO CALL AND DISCUSS YOUR MARKETING PROBLEMS.

COVENT GARDEN MARKET

LIST OF NEW MEMBERS

(Up to and including 15th November, 1950.)

Ady, J. E.	Silvercross, Rowly Drive, Cranleigh	Surrey
*Atkins, P. C.	368 Fulbridge Road, Paston, Peterborough	Northants.
Allan, F.	Cedars, Forgandenny, Perthshire	Scotland
Baker, E.	c/o Geo. Smalley Ltd., Sneinton Market, Nottingham	Notts.
*Bennett, A. D.	64 Ashley Road, Dovercourt	Essex
Boland, Miss E. M.	Glenarde, Galway	Eire
Currie, W. D.	Rylthorpe, Chudleigh, Nr. Newton Abbott	Devon
*Dingwall, I. G. P.	College of Agriculture, 5 Rose Terrace, Perth	Scotland
Galbraith, W. S.	Albethy, Bridge of Allan, Stirlingshire	Scotland
*Garner, W. R.	140 St. Annes Road E., St. Annes-on-Sea	Lancs.
*Gleave, D. B.	264 Church Road, Haydock, St. Helens	Lancs.
*Hayward, W. T.	86 Cummings Drive, Mount Florida, Glasgow	Scotland
Hepher, F. W.	Hillcot, Calver, Sheffield	Yorks.
*Jones, L. F.	14 Lower Meddon Street, Bideford	N. Devon
*Keens, W. F.	29 Meadway Drive, Horsell, Woking	Surrey
Kevan, D. R.	Beamsmoor, Sedbergh	Yorks.
*Lachlan Mushroom Co.	22 Fitzroy Street, Cowra 3W, New South Wales	Australia
Lee, C. C.	Pilton Manor, Oundle, Peterborough	Northants.
Mount, E. H.	Pembroke Lodge, Dover Road, Walmer	Kent
*Percy, E. J. V.	Park Cottage, Hartwell, Aylesbury	Bucks.
Possingham, J. V.	"Trevor," Main Road, Blackwood	South Australia
*Redwing Forest Products Ltd.	Reliant Works, Brockham, Betchworth	Surrey
Riddlesdown Mushroom Farm	Riddings Cottage, Harestone Hill, Caterham	Surrey
*Smalley, Geo. Ltd.	Sneinton Market, Nottingham	Notts.
*Stockwell, J. A.	St. Ives, Rydens Avenue, Walton-on-Thames	Surrey
Wallace, W. R.	Roseneath Gardens, Stockton Hill, Dawlish	Devon
Walravens, W. R.	Drie Egypten, Gooik (Br.)	Belgium
*Wells, J. A.	66 Peabody Road, South Farnborough	Hants.

*indicates Honorary Members

MEMBERS' ADVERTISEMENTS

ROLLER CONVEYORS : 20 surplus 8′ lengths, 15″ wide @ 9/- per foot on site. R. Duthy, Little Horkesley, Nr. Colchester.

FOR SALE : "Sterilatum," 1 c. yd. size portable sterilizer complete and practically new. Offers :—Harding Brothers, Stone Lodge Farm, Tenterden, Kent.

NORTHAMPTON. Excellent Mushroom Farm for sale. Three properly constructed houses giving a total growing area of 5,400 sq. ft. Excellent yield. Manure and all facilities available. Details PHELAN & AGUTTER, 17 Market Square, Northampton. Tel. 1905, 4580/1.

FOR SALE, VERWOOD, DORSET. Excellent Mushroom Industry, 14,200 sq. ft. growing area. Boiler house ; 3 Composting Sheds 120′ × 25′ ; Brick-built office and packing house. Large storage space 120′ × 35′. **3 NEWLY ERECTED PIGSTIES.** GOOD LIVING ACCOMMODATION : 2 Beds., Lounge, Kitchen/Breakfast Room. Bathroom. All Main Services. Telephone. Approx. 21 Acres of Land. 300 yd. main road frontage. £7,500 a.a. Freehold. Further details from Sole Agents : ROLAND, BEWICK & CROSS, 44 East Street, Wimborne. Wimborne 657.

FOR SALE : Binocular Microscope by Smith & Beck, London, complete with three sets of eyepieces, three magnification units, and all accessories in mahogany case. Price £30 or near offer. E. J. Hall, Layer Mills, Colchester, Essex.

FOR SALE : 300/400 ex-government photographic or ammunition boxes, 3′ × 1′ × 9″ (deep)—many with interior metal linings. D. Wyllie, 21 Carrick Road, Ayr.

Just another of our many satisfied customers writes:

Dear Sirs,

Crops resulting from your manure have been very satisfactory and in this connection I am at present expanding fairly extensively.

Yours faithfully,

N.R.C.

★

ROAD OR RAIL TO ANY DISTRICT

★

BULLOCK & FARMYARD MANURE ALWAYS AVAILABLE

★

STABLE MANURE

W. STEVENS

THORNWOOD COMMON

Near EPPING, Essex

Telephone: EPPING 2253 (3 Lines)

Order Now for your Season's requirements

MR. G ROWER
I MUST DROP IN ON THE THWAITES ORGANISATION
LIVERPOOL
MANCHESTER
CARDIFF
LONDON